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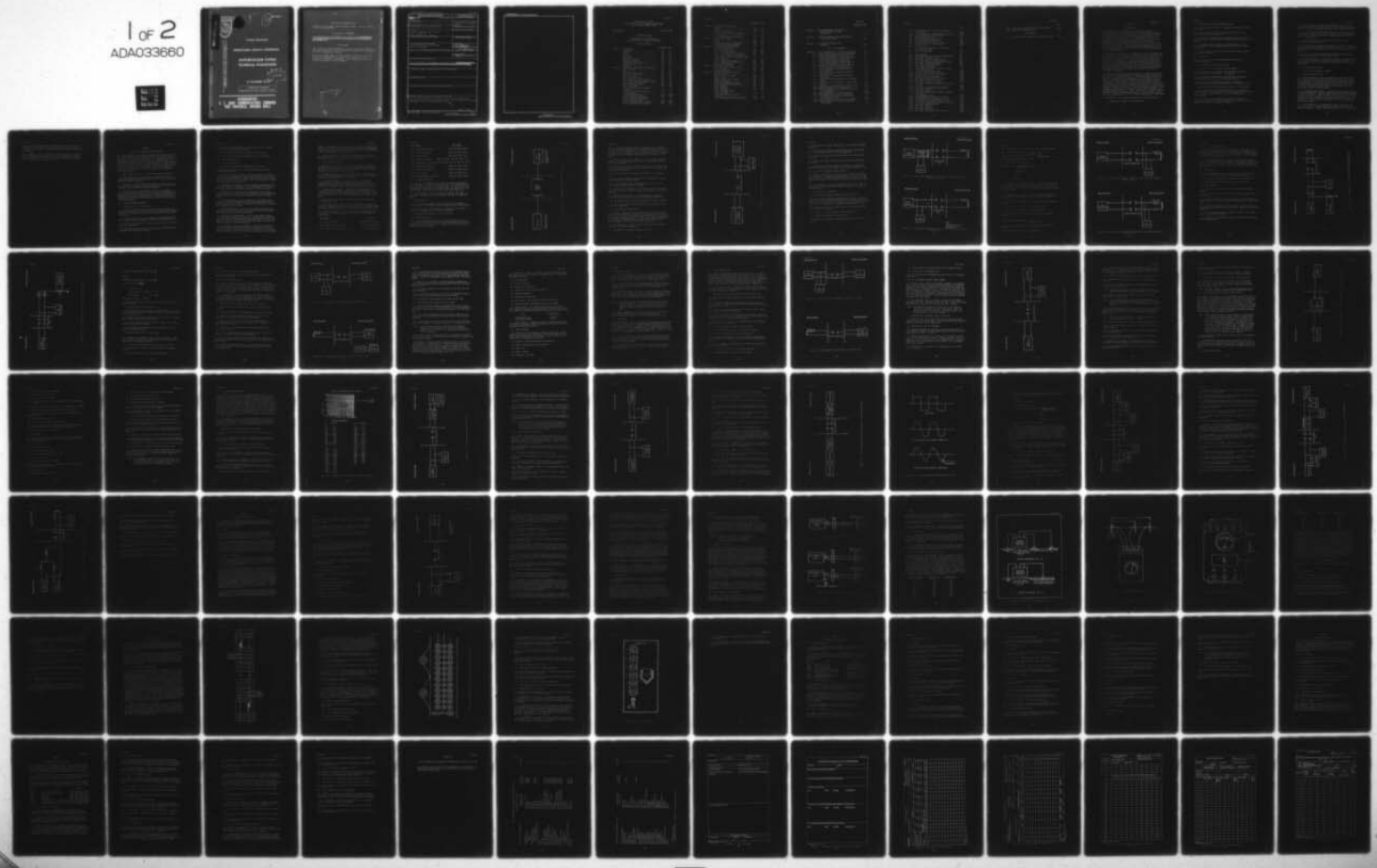

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VOICE OF THE ARMY

Product Assurance

OPERATIONAL QUALITY ASSURANCE

AUTOSEVOCOM SYSTEM TECHNICAL EVALUATION

15 OCTOBER 1976

HEADQUARTERS
U. S. ARMY COMMUNICATIONS COMMAND
FORT HUACHUCA, ARIZONA 85613

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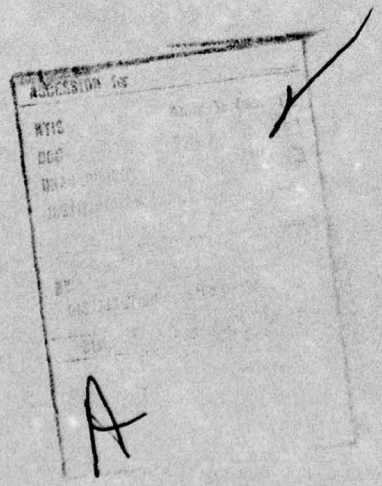

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The test and evaluation procedures have been developed as a diagnostic tool to aid in attaining high quality and cost effective performance from the AUTOSEVOCOM system.

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DEPARTMENT OF THE ARMY
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Product Assurance

OPERATIONAL QUALITY ASSURANCE
AUTOSEVOCOM SYSTEM TECHNICAL EVALUATION

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CHAPTER 1

INTRODUCTION

1-1. BACKGROUND. The Automatic Secure Voice Communications (AUTOSEVOCOM) system is a vital part of the overall worldwide communications network. Efforts at system analysis and evaluation have been on a piecemeal basis and, to date, no systematic evaluations of the AUTOSEVOCOM system have been made. The AUTOSEVOCOM Technical Evaluation Program (ATEP) has been developed to determine the transmission characteristics and functional capabilities of the worldwide AUTOSEVOCOM system by analyzing the data obtained from extensive tests and alignment procedures. Detailed surveys and evaluations, when conducted according to Army regulations and Defense Communications Agency circulars, are intended to show the total system functional capability of the AUTOSEVOCOM network.

1-2. PURPOSE. The purpose of this pamphlet is to set up standard testing procedures that will allow an indepth view of the entire AUTOSEVOCOM system. These tests are designed to check the overall performance capabilities of the system and to determine possible problem areas that might occur. This pamphlet is in support of the USACC Quality Assurance Program for Operational Communications Systems and Facilities, CCP 702-1-3. The material contained in this document is basically a compendium of instructional notes developed, or compiled, by the 6th Signal Technical Evaluation Detachment, and follows the guidelines given in the DCS Quality Assurance Program, DCA Circular 310-70-57, with Supplements 1 through 6.

1-3. METHOD. Based on data from these surveys, combined transmission and functional evaluations will be standardized to improve operational, logistical, and maintenance practices. These standards have been formulated to provide an overall improvement in the AUTOSEVOCOM system. This pamphlet details specific test procedures for effective analysis of transmission characteristics and includes guidelines for the functional operation of the ATEP. Chapters 2 and 3 cover audio testing with tests and alignments that are the direct responsibility of the AUTOSEVOCOM Technical Evaluations Teams (ATET). These tests can be performed by local commands; however, because of extensive test equipment required, local commands cannot perform all the tests. Chapters 4, 5, 6, and 7 cover the performance tests and alignment procedures of the AUTOSEVOCOM equipment and are the responsibility of both the local commands and the ATEP teams.

1-4. OBJECTIVES. The long-range objectives of the evaluations are:

a. Acquisition, analysis, and evaluation of:

(1) AUTOSEVOCOM transmission characteristics.

(2) Noise interference data as encountered in operational AUTOSEVOCOM systems.

(3) Maintenance, operational, and logistical data to provide information for efficient operation.

b. Development, application, and enforcement of improved operational, logistical, and maintenance standards, methods, procedures, and criteria.

c. Development, implementation, and recommendations for cost effective modernization to upgrade facilities and insure customer satisfaction.

d. Update transmission data and operational performance status to support future planning.

1-5. REFERENCES.

a. DCAC 300-175-9, DCS Operating-Maintenance Electrical Performance Standard.

b. DCAC 310-70-1, DCS Technical Control.

c. DCAC 310-70-57, DCS Quality Assurance Program.

d. KAM 153B/TSEC, KAM 154B/TSEC, KAM 155B/TSEC, Maintenance Manuals TSEC/HY-2 and TSEC/HY-2A. (Unclassified.)

e. KAM 159C/TSEC, KAM 160C/TSEC, KAM 161C/TSEC, Maintenance Manuals, TSEC/KY-3, TSEC/KY-3A. (Confidential-Crypto.)

f. KAM 175A/TSEC, KAM 176A/TSEC, Repair and Maintenance Instructions for TSEC/KG-13 and TSEC/KG-13A. (Confidential-Crypto.)

g. KAM 278/TSEC, Maintenance Manual TSEC/HY-11. (Unclassified.)

h. TM 11-5805-378-14/1 (NAVSHIPS 0967-246-5010, TO 31W2-2FTC-31-1), Operator, Organizational, DS and GS Maintenance Manual, Central Office, Telephone Dial AN/FTC-31 (V), (On site Maintenance). (Unclassified.)

i. TM 11-5805-570-15 (NAVELEX 0967-291-5013, TO 31W2-2G-71) Operator's, Organizational, Direct Support, General Support and Depot Maintenance Manual for Telephone Set TA-814/G.

j. TM 11-5805-486-15 (NAVSHIPS 0967-325-901D, TO 31W2-4-171-1) Operator's Organizational; Direct Support, General Support, and Depot Maintenance Manual, Switchboard, Telephone, Manual SB-3259/G (SECORD).

k. TM 11-5805-620-14 (NAVELEX 0967-426-9010, TO 31W-1-481), Operator's Organizational, Direct Support, General Support and Depot Maintenance Manual: Automatic Secure Voice Communications (AUTOSEVOCOM) System. (Confidential.)

l. TM 11-5895-543-35, DS, GS and Depot Maintenance Manual, Synchronizer Electrical SN394(V)/G.

m. TM 11-5895-576-15, Operator's Organizational, DS, GS, and Depot (NAVSHIPS 0967-291-4012, TO 31W2-2G-81) Maintenance Manual: Narrowband Subscriber Terminal, Narrowband Trunk Unit; and Switching Control Units SA-1635/G.

n. CCR 702-1-3, USACC Quality Assurance Program for Operational Communications-Electronics Systems and Facilities.

1-6. EVALUATION SEQUENCE. The evaluation sequence is designed to give the team an orderly, efficient method for evaluating a facility in a minimum amount of time. The evaluation sequence can be divided into three phases:

a. Initial performance check.

b. Complete system/equipment alignment.

c. Final performance check.

1-7. EVALUATION RESULTS. After the evaluation, a complete analysis will be made to ascertain problem areas still existing. The results and recommendations for corrective actions will be forwarded to the responsible agency for action. After corrections have been completed, a reevaluation of affected AUTOSEVOCOM circuits will be made by the responsible O&M command and the results will be forwarded to the appropriate technical evaluation agency.

1-8. RECOMMENDED TEST EQUIPMENT. A listing of preferred test, maintenance, and diagnostic equipment (TMDE) necessary to perform the tests, is shown in appendix A. Other equipment may be used if the electrical characteristics are equivalent to those of the recommended item. The impedance and dynamic range of other equipment must be equivalent and compatible, and accuracy must be as good or better than standards for the preferred TMDE.

1-9. TEAM COMPOSITION. The AUTOSEVOCOM technical evaluation team ATET is composed of technical experts who perform the AUTOSEVOCOM technical evaluation. Teams will normally have four to six personnel,

including an officer team leader, ciphony technicians, a technical controller or an AUTOSEVOCOM systems technician, and an AN/FTC switch repairman, when required. As many team members as possible should have SI clearance.

1-10. COMMENTS. Users of this pamphlet are encouraged to submit comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications) direct to Commander, US Army Communications Command, ATTN: CC-OPS-OX, Fort Huachuca, AZ 85613.

CHAPTER 2

AUDIO TESTS, PROCEDURES, AND GUIDELINES

2-1. TEST PROCEDURES. This chapter contains tests and procedures for the audio portion of the AUTOSEVOCOM network. These tests are used primarily by the ATET and are not part of the local preventive maintenance program. When used in conjunction, the "wideband tests" and "equipment performance tests" are intended to show the capabilities of the entire system and possible future problem areas. Tutorial information is included in the test procedures. Appendix A contains the test cover page and test forms. Specific data sheets are included for recording the required data. They may be extracted and reproduced locally, as required.

2-2. DATA. Types of data to be collected are defined as follows:

a. Preliminary Data. Data gathered on a particular circuit or system that indicate actions are necessary for the system to meet the required performance standards.

b. Final Data. All data gathered from tests on circuits or systems that meet the necessary performance standards or on systems that corrective actions cannot be initiated immediately.

c. Additional Data. Supporting data. Before the evaluation team's detailed measurement survey, the appropriate O&M command headquarters personnel will complete a physical inspection and survey of applicable system records and drawings. The additional data will be organized and displayed to give an overall preliminary indication of the system operation.

2-3. EVALUATION MASTER CHECKLIST.

a. Preparations Prior to Evaluation.

(1) Prior to actual evaluation, the individuals responsible for conducting the evaluation will insure that all necessary test equipment (see app A) and associated connectors are on hand and in good working condition.

(2) A check will be made to insure that all forms and data sheets are on hand in sufficient quantity to complete the required reports.

(3) The test team leader will prepare a provisional plan for conducting the evaluation.

(4) Sufficient advance notice will be given for station personnel to perform known required maintenance.

b. Initial Briefing/Interviews. The test team chief's entrance briefing to the commander will include:

(1) The long-range and immediate goals of the evaluation.

(2) Milestones to identify functional areas to be evaluated.

(3) Time frame involved.

(4) Assistance required.

(5) Possible communications degradation that may occur.

Following the briefing, the test team leader will interview the AUTOSEVOCOM supervisors.

c. Walk Through and Orientation. The initial station evaluation will consist of a general walk through and orientation and a quick review of equipment assignments, records, and line record cards. Evaluation team personnel will be located so that routine duties of station personnel will not be interrupted.

d. Preliminary Measurements. After preparatory requirements have been met, preliminary measurements of the AUTOSEVOCOM system will be performed according to directions outlined in the test procedures.

e. Repair Action. Based on results obtained from the overall system measurements, all possible corrective action will be undertaken by station personnel with technical assistance from the evaluation team.

f. Final Measurements. After completing all preliminary measurements on a particular AUTOSEVOCOM system, and accomplishing all on-the-spot corrections possible, final measurement data will be collected and recorded on the data sheets.

g. Test Procedure Review. The test team leader will review each test report in detail to insure that the test was properly performed and that the data were accurately recorded.

h. Evaluation of Recorded Data. Prior to final report preparation, all recorded and tabulated data will be evaluated for completeness, accuracy, and cross-correlation with other applicable data. Any datum that does not correlate closely with other data is suspect and further evaluations should be conducted.

i. Final Report Preparation and Review. After the above actions have been completed, the final report will be assembled. The test team leader will review the total report in detail to verify all data, add the page numbers and table of contents, and prepare the performance

summary. The comments section of the test cover page (fig A-1, USACC Form 351-R (Test)) will be used for the summary portion of the report. The page following the cover page (fig A-2, USACC Form 352-R (Test)) will contain station and personnel information.

j. Electrical Safety. Throughout the testing, every precaution must be taken to protect the team members and station personnel from the risk of electrical shock and other ground hazards.

2-4. DATA SHEET INSTRUCTIONS.

a. Data Sheets. Specific data sheets are provided to record all required data. Necessary graphs for plotting required curves are also included. Fill in the test cover page of each data sheet completely and comply with all test data instructions.

b. Signing, Checking, and Verifying Data Sheets. The test team leaders will verify as accurate the results recorded on each individual data sheet before certification of the sheet.

c. Clarifying Comments. The cover page for each data sheet includes space for comments concerning the test. Abnormalities in procedures or changes that may reflect possible data errors will be listed and the suspected causes of abnormal results will be recorded.

d. Absolute Meter Readings. Initially, all measured data are to be entered on the data forms as absolute (i.e., dbm absolute). Based on these readings, the values entered in dbm, etc., are listed. Draw all curves with scaling in dbm or other appropriate corrected relative levels.

e. Test Points. The facility tested is listed on the cover page of each test data sheet.

f. Test Tone Levels. Except in special cases where crosstalk must be held to a minimum, the test tone levels will be -10 dbm0 for narrowband and 0 dbm0 for wideband. Enter any differences on the data sheet.

2-5. ORDER OF TESTING. The order of testing (AUTOSEVOCOM Test (AT)) listed here is a suggested sequence that will assist in identifying problem areas.

TEST NUMBER		FORM NUMBER
AT-1	Test Tone Level	USACC Form 353-R (Test)
AT-2	Inservice Customer Levels	USACC Form 354-R (Test)
AT-3	Channel Impedance (Manual Sweep)	USACC Form 355-R (Test)

TEST NUMBER		FORM NUMBER
AT-4	Longitudinal Balance	USACC Form 356-R (Test)
AT-5	Idle Channel Noise	USACC Form 357-R (Test)
AT-6	Impulse Noise	USACC Form 358-R (Test)
AT-7	Frequency Response	USACC Forms 359, 360, 362, 363 (Test)
AT-8	Envelope Delay Distortion	USACC Forms 359, 361, 362, 364 (Test)
AT-9	Harmonic Distortion	USACC Form 365-R (Test)
AT-10	Frequency Translation	USACC Form 366-R (Test)
AT-11	Phase Jitter	USACC Form 368-R (Test)
AT-12	Intermodulation Distortion	USACC Form 369-R (Test)

2-6. AT-1, TEST TONE LEVEL.

a. General. The purpose of this test is to measure the level of a test tone signal. This test will be performed on all AUTOSEVOCOM circuits and will be recorded as preliminary data. If there are no major discrepancies when compared to predicted levels, the data will be considered final. Record the data on USACC Form 353-R, figure A-3.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B) or equivalent; cords and connectors; resistors, 600 ohms, 135 ohms, 900 ohms.

c. Specifications.

(1) If the measured signal is more than ± 1 db out of tolerance the circuit will be realigned to correct levels before further testing.

(2) In most VF circuits impedance is 600 ohms but on some cable circuits the impedance will be as high as 900 ohms.

d. Narrowband Test Procedures (refer to fig 2-1).

(1) Calibrate test set.

(2) At the transmit terminal prior to connecting the oscillator into the circuit, terminate it into a resistor which matches the input impedance of the circuit and set the output level of the oscillator to 1 kHz at a level of -10 dbm0.

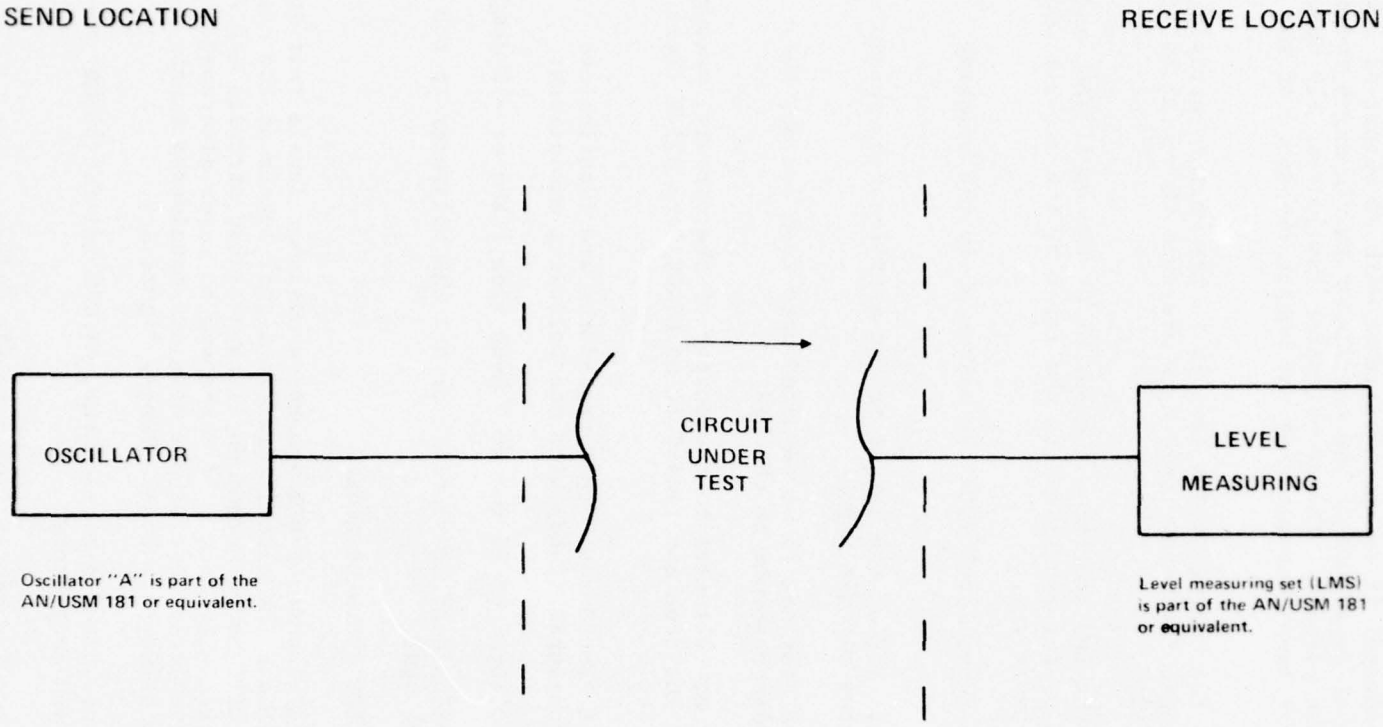


Figure 2-1. Test configuration for 1 kHz test tone level.

(3) At the receive terminal prior to connecting the ac voltmeter into the circuit, connect it to the oscillator with an output of 1 kHz -10 dbm0. The output impedance of the oscillator should match the output impedance of the circuit. The ac voltmeter should read -10 dbm0 at 1 kHz with the input impedance matching the output impedance of the circuit.

(4) Insure that the circuit under test is in the normal operating condition. (If single frequency (SF) units are used they will be in the off-hook condition.)

(5) Disconnect the resistor from the output of the oscillator and connect the output of the oscillator to the input of the circuit under test as shown in figure 2-1.

(a) Monitor the input level with the voltmeter in the bridging mode.

(b) If necessary, adjust the output of the oscillator to obtain a -10 dbm0 level at the circuit input.

(c) If the oscillator has to be adjusted more than 0.5 db, the circuit input impedance should be checked.

(d) Connect the ac voltmeter to the output of the circuit, measure the level of the 1 kHz tone and record it on USACC Form 353-R (Test), figure A-3.

e. Wideband Test Procedures. Test procedures are identical to narrowband test procedures (2-6d) with the following exceptions:

(1) Use standard level of 25 kHz at 0 dbm0 vice 1 kHz at -10 dbm0.

(2) Set the impedance of the oscillator and the voltmeter to the 135-ohm terminating mode.

2-7. AT-2, INSERVICE CUSTOMER LEVELS.

a. General. The purpose of the inservice customer levels test is to measure and evaluate the circuit traffic signal levels of the customer. This test will be performed on all subscribed circuits and will be recorded as preliminary data. If there are no major discrepancies when compared to predicted levels, the data are considered final. Record the data on USACC Form 354-R (Test), figure A-4.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B) or equivalent; cords and connectors.

c. Narrowband Test Procedures (refer to fig 2-2).

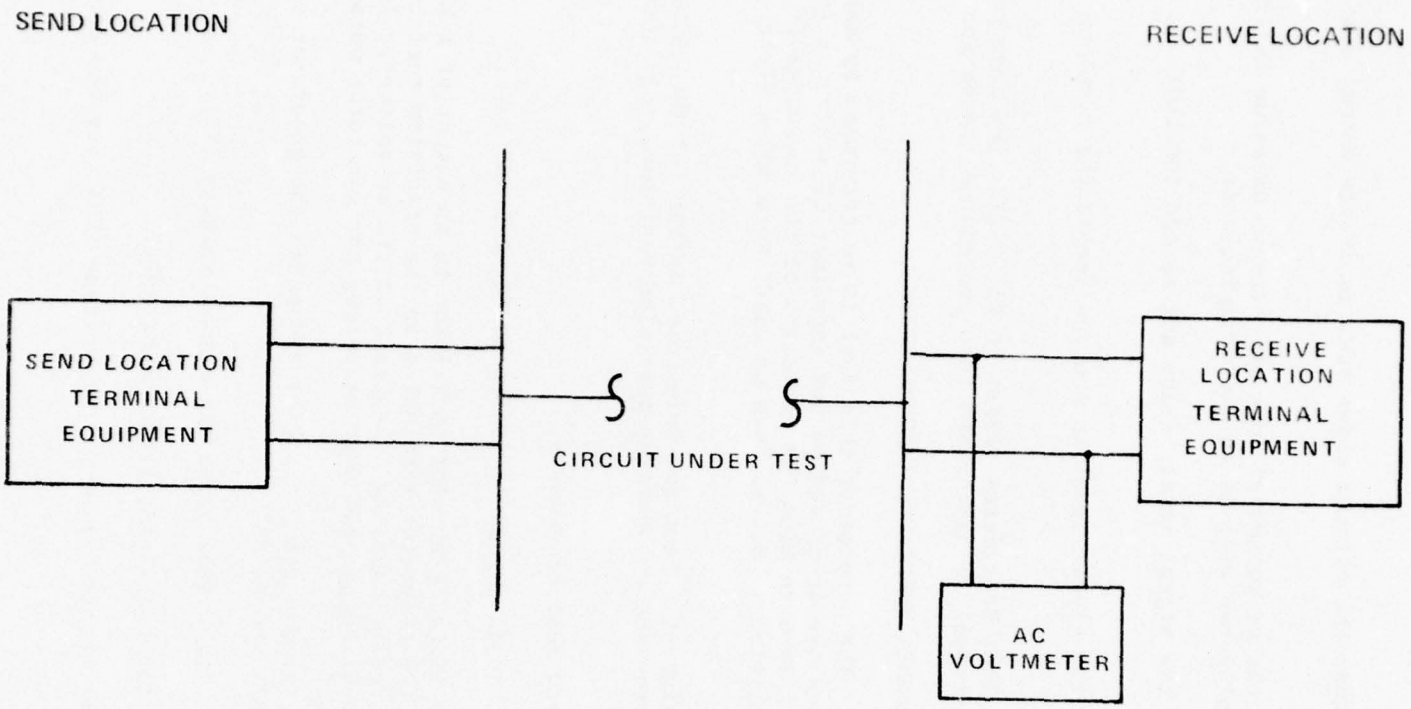


Figure 2-2. Inservice customer levels test configuration.

(1) Insure that the circuit under test is in its normal operating condition.

(2) Connect the ac voltmeter into the circuit as shown in figure 2-2. The ac voltmeter will be in the bridging mode.

(3) Measure the signal level in dbm and record the level on the data sheet.

(4) Measure the cipher level in dbm and record the level on the data sheet.

d. Wideband Test Procedures (refer to fig 2-2). The test procedures are identical to narrowband test procedures, paragraph 2-7c.

2-8. AT-3, CHANNEL IMPEDANCE (MANUAL SWEEP).

a. General. The purpose of this test is to determine by manual sweep techniques the input and output impedance of a circuit (or any test equipment) to determine the deviation of the impedance from the design specifications. Record data on USACC Form 355-R (Test), figure A-5.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B) or equivalent; cords and connectors; precision resistors, 135 ohms, 600 ohms, 900 ohms.

c. Narrowband Test Procedures.

(1) Input channel impedance (refer to fig 2-3 and 2-4).

(a) Set the signal generator oscillator to an output of 1 kHz at -10 dbm0 with the generator terminated in the precision resistor that matches the circuit impedance. Insure that the ac voltmeter is in the circuit in the bridging mode when measuring the generator output.

(b) Remove the precision resistor and patch the generator output into the circuit under test.

(c) Measure the signal generator output voltage (VT).

(d) Remove the oscillator from the circuit.

(e) Measure the oscillator output voltage (VO) over the open circuit.

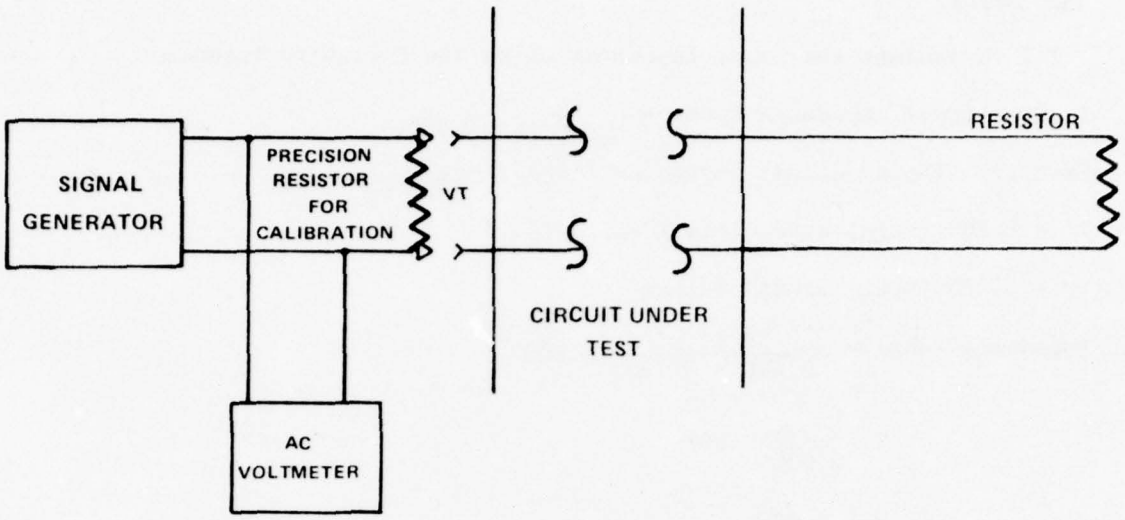


Figure 2-3. Circuit input impedance configuration for measuring terminated circuit voltage (VT).

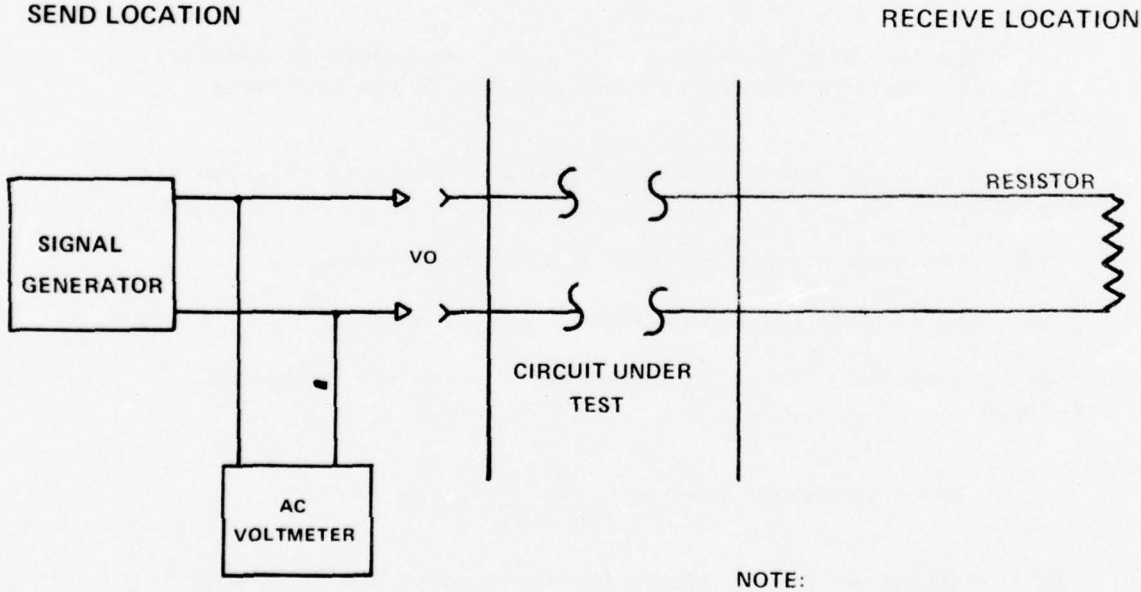


Figure 2-4. Circuit input impedance configuration for measuring open circuit voltage (VO).

(f) Calculate the input impedance using the following formula:

$$\text{Input circuit impedance (ohm)} = \frac{VT}{VO - VT} \times 600$$

Example: $$\text{Input circuit impedance (ohm)} = \frac{VT}{VO - VT} \times 600$$

VT = 0.235 (terminated circuit voltage)

VO = 0.470 (open circuit voltage)

$$\text{Impedance (ohm)} = \frac{0.235}{0.470 - 0.235} \times 600$$

$$= \frac{0.235}{0.235} \times 600$$

$$= 1 \times 600$$

$$= 600 \text{ ohms}$$

(2) Output circuit impedance. Repeat the entire test procedure for the output of the circuit. In this case the test tone will be connected to the output of the circuit under test with the distant end terminated (fig 2-5 and 2-6). Compute the data using the output impedance formula.

d. Wideband Test Procedures. This test procedure is identical to narrowband test procedures (para 2-8c) with the following exceptions:

(1) Set the output impedance of the oscillator to 135 ohms vice 600 ohms.

(2) Terminate the circuit with a 135 ohm-resistor.

(3) Set the level (standard) to 25 kHz at 0 dbm0.

(4) Calculate circuit input impedance using the following formula:

$$\text{Circuit input impedance (ohm)} = \frac{VT}{VO - VT} \times 135$$

(5) Calculate circuit output impedance using the following formula:

$$\text{Circuit output impedance (ohm)} = \frac{VO - VT}{VT} \times 135$$

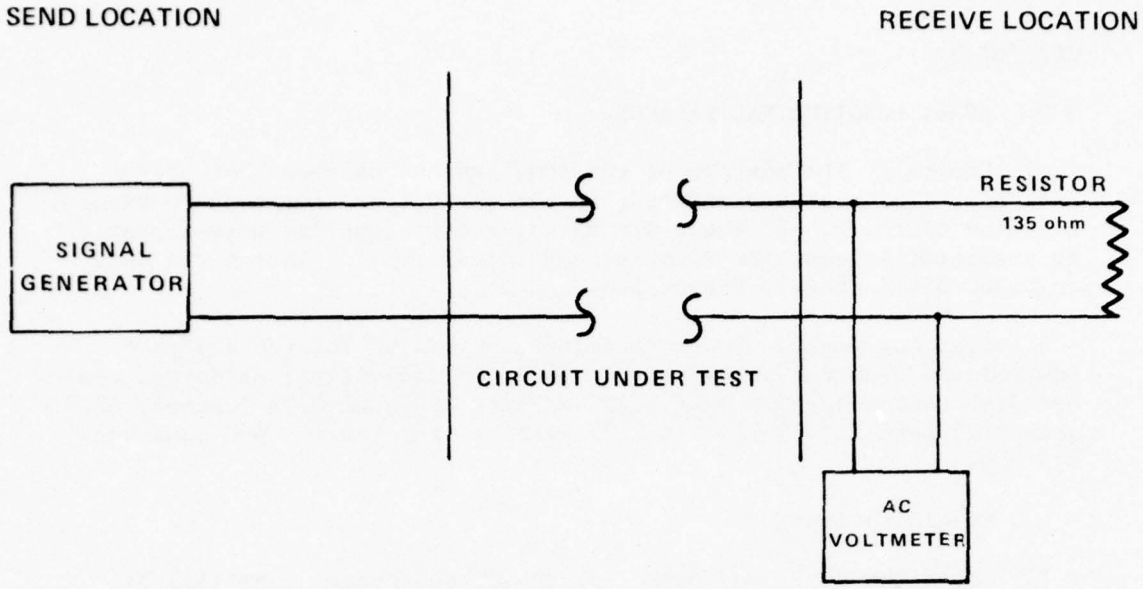


Figure 2-5. Circuit output impedance configuration for measuring terminated circuit voltage.

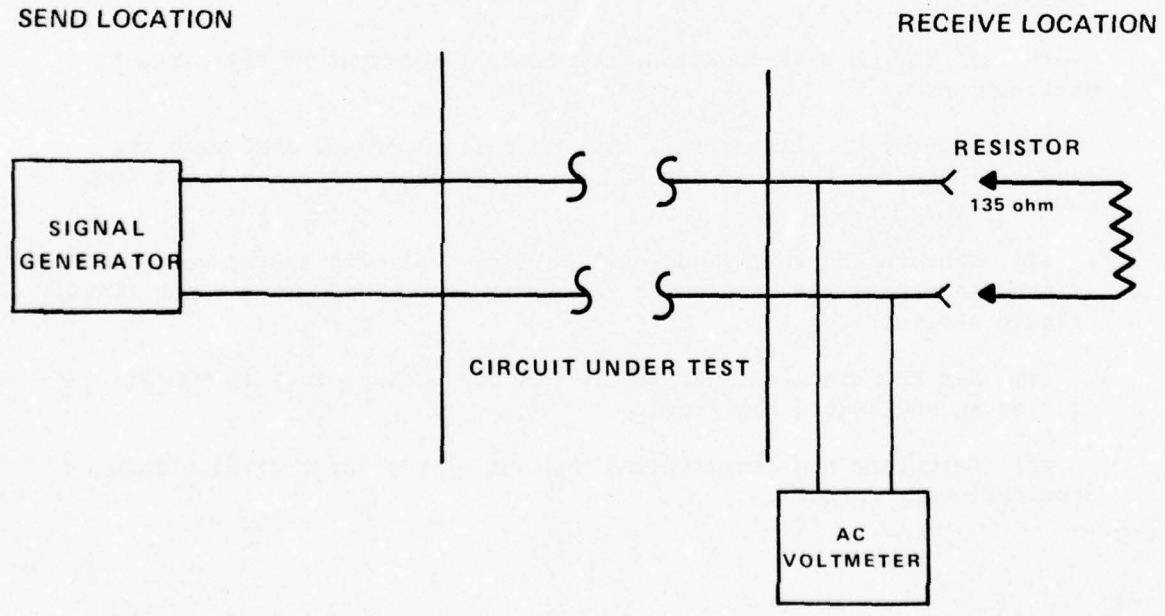


Figure 2-6. Circuit output impedance configuration for measuring open circuit voltage (VO).

2-9. AT-4, LONGITUDINAL BALANCE.

a. General. The purpose of the longitudinal balance test is to determine the imbalance existing in the circuit or equipment by using balanced circuits. If there are no major discrepancies when compared to predicted levels, the data are considered final. Record the data on USACC 356-R (Test), figure A-6.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B) or equivalent; spectrum analyzer, HP 3580A, or equivalent; cords and connectors; resistors, 300 ohms 0.25 percent, 150 ohms 0.25 percent, 67.5 ohms 0.25 percent, 33.75 ohms 0.25 percent, termination 600 ohms and 135 ohms.

c. Specifications.

(1) Both the input and output of the circuit under test will be disconnected from the signal source and terminal equipment.

(2) Tests will be conducted in both directions of transmission.

d. Narrowband Test Procedures (refer to fig 2-7 and 2-8).

(1) Input circuit.

(a) The circuit under test should be in its normal operating condition.

(b) At the receive location, terminate the output of the circuit with 600 ohms.

(c) Set the oscillator to 1 kHz, at a level of -10 dbm0 with the output impedance that matches the input impedance of the circuit (600 ohms).

(d) Measure the voltage across the line (V_1) with the ac voltmeter and record the reading on the data sheet, USACC Form 356-R (Test), figure A-6.

(e) Set the spectrum analyzer to measure voltage (V_1) at 600 Hz across R_3 and record the reading.

(f) Calculate the longitudinal balance of the input circuit using the following formula.

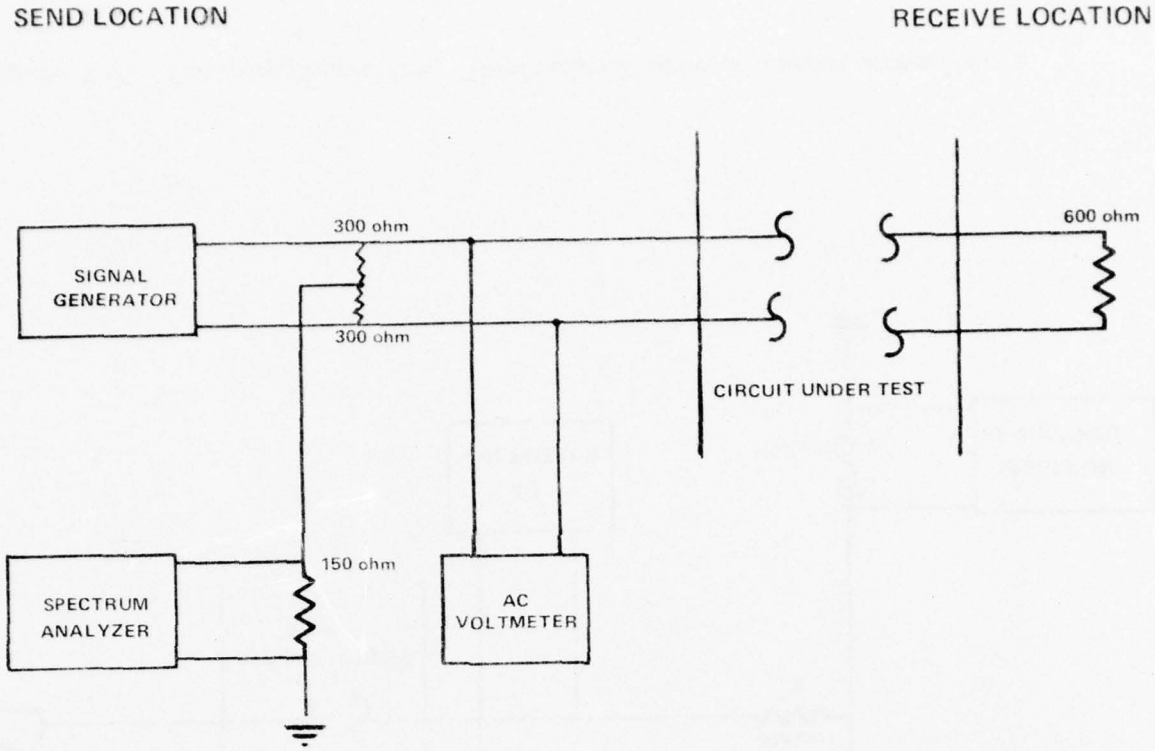


Figure 2-7. Test configuration, longitudinal balance input circuits.

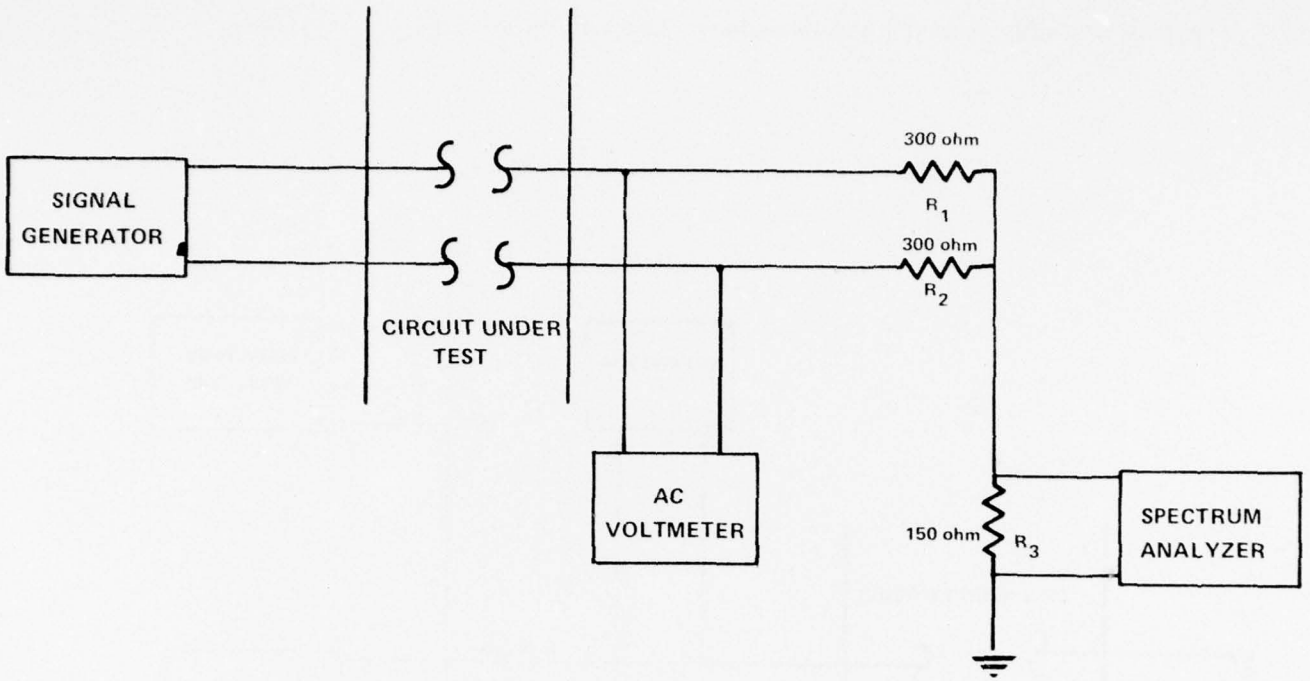


Figure 2-8. Test configuration, longitudinal balance output circuits.

Longitudinal balance (db) - 20 log 10 $\frac{V_1}{V_2}$

Example:

Longitudinal balance (db) - 20 log 10 $\frac{V_1}{V_2}$

LB (db) = 20 Log 10 $\frac{0.245}{0.001}$

= 20 log 10 245

= 20 (log 10 245 - 2.3891) V1 = 0.245

= 20 (2.3891 V2 = 0.001

Longitudinal balance - 47.78 db

(g) Measurements and calculations will be made for signals of 1 kHz and 2.4 kHz.

(2) Output circuit (refer to fig 2-8).

(a) At the send location, set the oscillator to 600 Hz at a level of -10 dbm0 with the output impedance matching the input impedance of the circuit (600 ohms).

(b) Measure the voltage across the line (V_1) with the ac voltmeter and record the reading on the data sheet.

(c) Set the spectrum analyzer to measure voltage (V_2) at 600 Hz across R3 and record the reading.

(d) Calculate the longitudinal balance of the output circuit using the following formula:

Longitudinal balance (db) = 20 log 10 $\frac{V_1}{V_2}$

e. Wideband Test Procedures (refer to fig 2-7 and 2-8). These test procedures are identical to narrowband test procedures (para 2-9d) with the following exceptions:

(1) Set the output impedance of the oscillator to 135 ohms.

(2) Terminate the circuit with 135-ohm resistor vice 600-ohm resistor.

(3) Resistors R_1 and R_2 be 67.5 ohms vice 300 ohms.

(4) Resistor R_3 will be 33.75 ohms vice 150 ohms.

(5) Make measurements and calculations at the following frequencies: 12, 25, and 50 mHz.

2-10. AT-5, IDLE CHANNEL NOISE.

a. General. The purpose of this test is to measure and evaluate the idle channel noise (ICN) online. Idle channel noise (also referred to as residual noise, basic noise, idle circuit noise, and random noise) is the noise present with no external signal applied. Record the data on USACC Form 357-R (fig A-7) for wideband and USACC Form 358-R (Test) (fig A-8) for narrowband.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B), or equivalent; transmission and noise measuring set, TA-885U (HP 3555B), or equivalent; balance/unbalance transmitter, HP 11005A, or equivalent; cords and connections; resistors, 600 ohms, 135 ohms.

c. Narrowband Test Procedures (refer to fig 2-9 and 2-10).

(1) Make sure the circuit under test is in its normal operating condition.

(2) Set the oscillator for a standard level of 1 kHz at -10 dbm0.

(3) Adjust the transmission and noise measuring set for level measurements in accordance with the operating manual.

(4) Measure the receive tone level with the transmission and noise measuring set and record it on the data sheet. (Figure A-7, USACC Form 357-R (Test).)

(5) Remove the oscillator from the circuit and terminate the circuit with 600 ohms.

(6) Set the transmission and noise measuring set for noise measurements in accordance with the operating manual.

(7) Set the transmission and noise measuring set for 3 kHz flat weighting and measure the ICN on the dbm and dbrn scale and record it on the data sheet.

(8) Change the weighting network on the transmission and measuring set to "C-message" and repeat the measurement of the ICN on the dbm and dbrn scale.

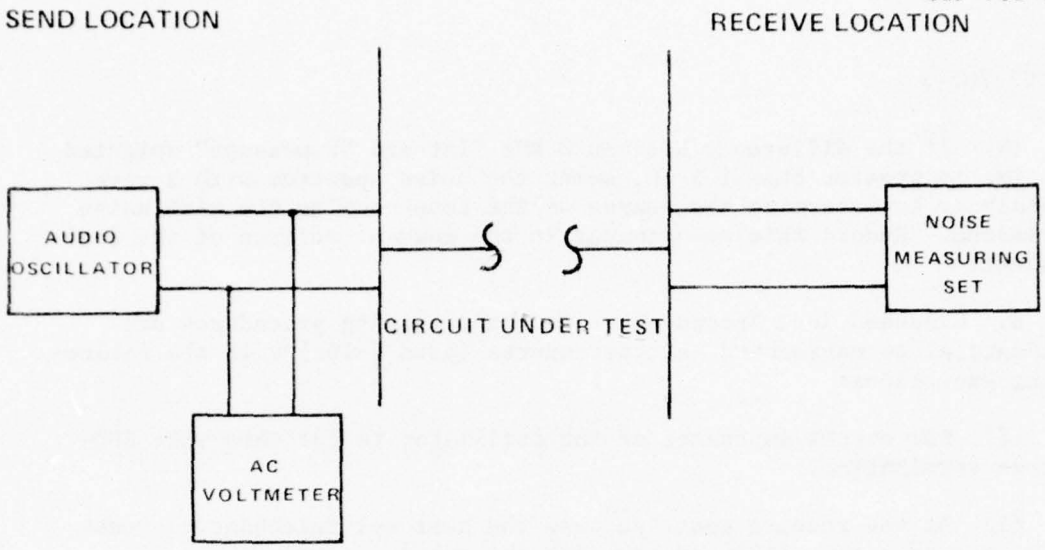


Figure 2-9. Configuration for measurement of receive tone level.

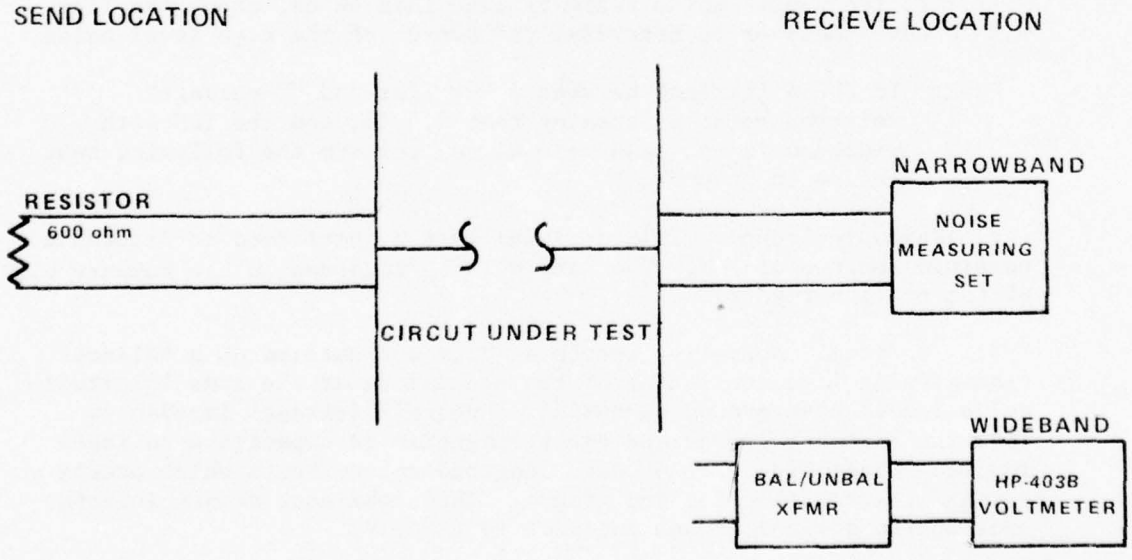


Figure 2-10. Configuration for measurement of idle channel noise.

(9) If the difference between 3 kHz flat and "C-message" weighted noise is greater than 1.5 db, sweep the noise spectrum with a wave analyzer to determine the source of the tone causing the high noise reading. Record this measurement in the comment section of the data sheet.

d. Wideband Test Procedures. Wideband testing procedures are identical to narrowband test procedures (para 2-10c) with the following exceptions:

(1) Set output impedance of the oscillator to 135 ohms vice 600-ohms termination.

(2) At the receive location, use the test set telephone to measure the test tone (135-ohm termination) receive level.

(3) Terminate the send location in 135 ohms vice 600 ohms.

(4) The standard level will be 25 kHz at 0 dbm0.

(5) Insert the balanced/unbalanced transformer into the circuit as shown in figure 2-10. Put the transformer in the high Z position and connect to the test set telephone patch panel in the 13552 position.

(6) Take noise measurements with the test set telephone in the <5 kHz and >5 kHz positions and record the values on the data sheet (fig A-7).

(7) If the signal noise ratio is less than 44 db, check the line with a wave analyzer to determine the source of the high level noise.

NOTE: If the difference between 3 kHz flat and "C-message" weighted noise is greater than 1.5 db, and the ICN with wideband is not less than 44 db, perform the following test (noise to ground).

e. Noise to Ground. This optional test is performed to determine possible sources of ICN. The data will be recorded in the summary block of the station report.

(1) General. Normally, speech or data are carried on a balanced transmission line consisting of two conductors at the same longitudinal balance above ground potential. Unequal (leakage) impedances from the lines to ground and electromagnetic or capacitive voltages induced in the line will produce longitudinal currents which create a voltage between the line and ground. This imbalance causes interference to the desired signal and adds to the ICN.

(2) Common noise sources. The amount of noise measured in a wire pair depends on, and is influenced by, numerous sources. Some of the most common types are--

(a) Poor grounding.

(b) Circuit crosstalk.

(c) AC power line induction.

(d) Impulse noise from transient radiation.

(e) Switching equipment.

(f) Central office batteries.

(g) Poor splices, loose terminals, and bad connections.

(h) Faulty soldering, dissimilar metals, and wet cables.

(3) Specifications. The following specifications are based on use of the cable for normal voice transmission; any other use of the cable requires parameters designed for the particular circuit involved.

Item	Minimum Value
Idle Channel Noise	40 dbrnCO
Longitudinal Balance	40 db

(4) Test equipment. Transmission and noise measuring set TA 885U (HP 3555B), or equivalent; cables, connectors, clips, test leads, and appropriate terminating resistors.

(5) Test procedures.

(a) Connect the test equipment as shown in figure 2-10. Terminate three cable pairs at a time using a 600-ohm termination on non-loaded pairs and 900 ohms on loaded pairs. Set the controls on the noise test set (for TA 885-U) as follows:

(1) Function: 600- or 900-ohm hold as appropriate.

(2) Input: Noise/terminate (blue setting).

(3) Power: On.

(4) Range: 30 dbrn.

(5) Weighting: C-message.

(6) Response: Normal.

(b) Connect the noise test set to each pair under test, individually. If noise fluctuations are evident, observe the readings for a sufficient length of time to establish an average value for that time period. Enter the noise reading in dbrnC on the summary sheet.

(c) To perform the noise to ground measurement, depress the function switch on the noise test set marked NG and connect the black binding post marked G to the station ground. Make the reading as in 2-10b(5) above.

(d) While reading ICN, some pairs will exhibit rapidly fluctuating high-impulse noise. When this occurs, move the response switch on the noise test set to the DAMP position and read the average level of the peaks. Make a note of these pairs and the readings obtained.

NOTE: Some pairs may exhibit excessive noise due to extra drops and/or bridging taps. On those circuits exhibiting excessive noise, check to see that such drops or taps are removed in order to establish the noise level for those pairs.

(e) After obtaining the raw noise value in dbrn, subtract this value from the ICN in dbrnC, this value is known as the circuit longitudinal balance. Note this value on the test form.

(6) Evaluation.

(a) If the level of ICN is in excess of the specification, attempt to establish its origin. If the readings indicate high fast hits of impulse noise, the noise may be caused by faulty switching equipment or loose connections. If the readings should continue, check with a telephone test set to establish if any foreign voltage, crosstalk, or interference is being picked up by the cable pair.

(b) Any pairs that do not meet specifications should be repaired and then retested. If a timely repair cannot be accomplished, the data sheet should be annotated to reflect the pairs that will require followup corrective action.

(c) As a final check of the test data, insure that all entries are complete and that pairs which failed to meet specifications are properly noted.

2-11. AT-6, IMPULSE NOISE.

a. General. The purpose of the impulse noise test is to measure and evaluate the number and levels of VF channel noise impulses, exceeding a specified reference level, that occur within the bandwidth of the channel under test during a specified time period. Measurement of impulse noise is necessary since short bursts of high intensity noise can change data waveforms and cause errors in contents of receive signal. Record the data on USACC Form 358-R (Test), figure A-8.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B), or equivalent; impulse noise measuring set, TTS 58B; cords and connectors; resistors, 600 ohms and 135 ohms.

c. Narrowband Test Procedures (refer to fig 2-11 and 2-12).

(1) Make sure the circuit under test is in its normal operating condition.

(2) Transmit a standard test tone (1 kHz at -10 dbm0) to the receive location. At the receive location, record the tone level and compute the error in db.

(3) At the send location, remove the oscillator from the circuit and terminate the circuit in 600 ohms.

(4) Adjust the impulse noise measuring set according to the operating manual, and connect the instrument into the circuit using a 600-ohm termination in a 3 kHz flat weighting mode.

(5) Initially, set the impulse noise measuring set in accordance with DCAC 310-70-1, Supplement 1.

(6) Record the counter settings on the data sheet.

(7) Record the impulse noise for a period of 15 minutes.

(8) Record the impulse noise counts on data sheet.

d. Wideband Test Procedures. The test procedures are identical to narrowband test procedures (para 2-11c) with the following exceptions:

(1) Set the impulse noise measuring set in the 135-ohm terminating mode vice 600 ohms.

(2) Terminate the circuit in 135 ohms vice 600 ohms.

(3) The standard level will be 25 kHz at 0 dbm0.

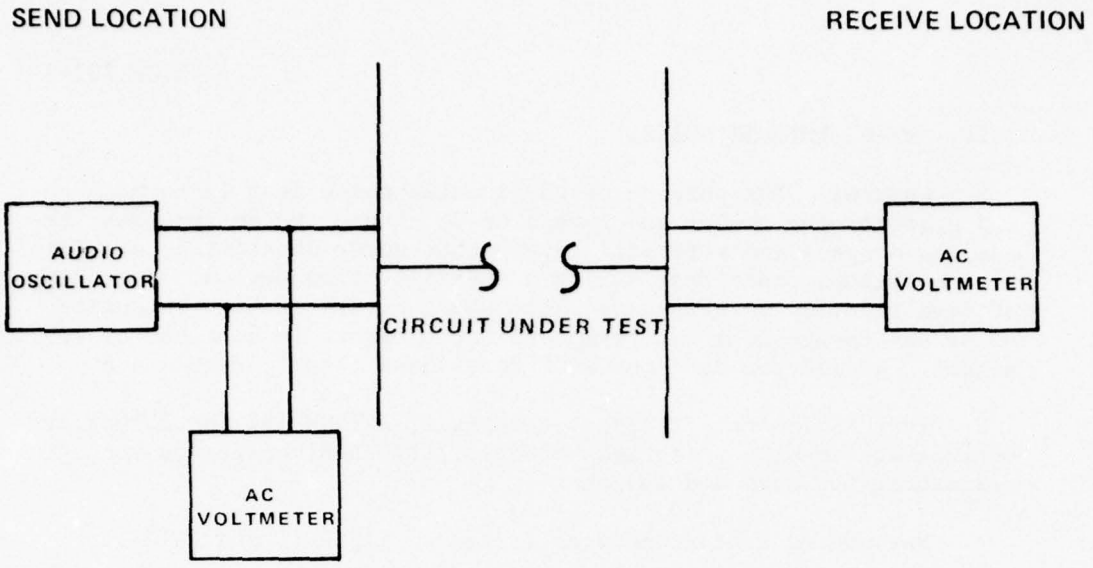


Figure 2-11. Configuration for measurement of receive tone level.

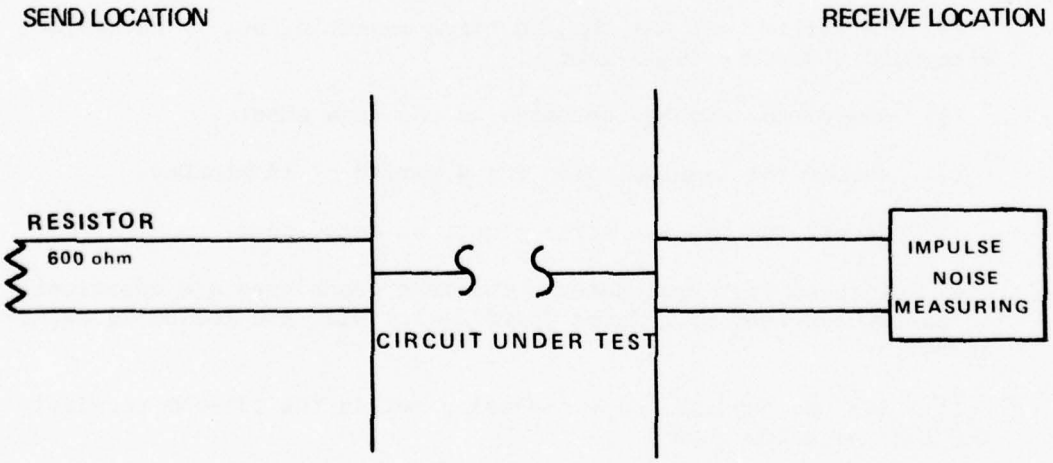


Figure 2-12. Configuration for measurement of impulse noise.

(4) Set the impulse noise measuring set to the wideband filter.

(5) Delete step 6 in paragraph 2-11c.

(6) Use the applicable parameters from DCAC 310-70-1 for wideband. (See app C.)

2-12. AT-7, FREQUENCY RESPONSE (MANUAL SWEEP).

a. General. The purpose of the frequency response test by manual sweep is to determine, by point-by-point measurements, the amplitude versus frequency response characteristics for individual circuits or equipment. This procedure permits the measurement of insertion loss versus frequency at the audio level, at the input and output of a circuit. The frequency response test shows the gain or loss of the circuit under test over the bandwidth of interest related to its gain or loss at a reference frequency. A sample worksheet is shown in figure A-9, USACC Form 359-R (Test).

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B), or equivalent; test set, frequency counter, HP 5300A, or equivalent; cords and connectors; resistors, 900 ohms, 600 ohms, and 135 ohms.

NOTE: When making the frequency response test on an equalized circuit all equalizers must be in the circuit. When this test is run over a position of an equalized circuit, all equalizers must be out of the circuit.

c. Narrowband Test Procedures (refer to fig 2-13).

(1) Make sure the circuit under test is in its normal operating condition. Data will be recorded on USACC Form 359-R (Test), figure A-9 and USACC Form 360-R (Test), figure A-10.

(2) Calibrate the test set telephone.

(3) Before connecting the oscillator into the circuit, make sure the termination matches the input impedance of the circuit and set the output level to 1 kHz at -10 dbm0.

(4) Before connecting the ac voltmeter into the circuit, connect it to the oscillator with an output of 1 kHz at -10 dbm0. The output impedance of the oscillator and the input impedance of ac voltmeter should match the output impedance of the circuit. The ac voltmeter should read -10 dbm0.

(5) Connect the ac voltmeter in the bridging mode to the output of the oscillator.

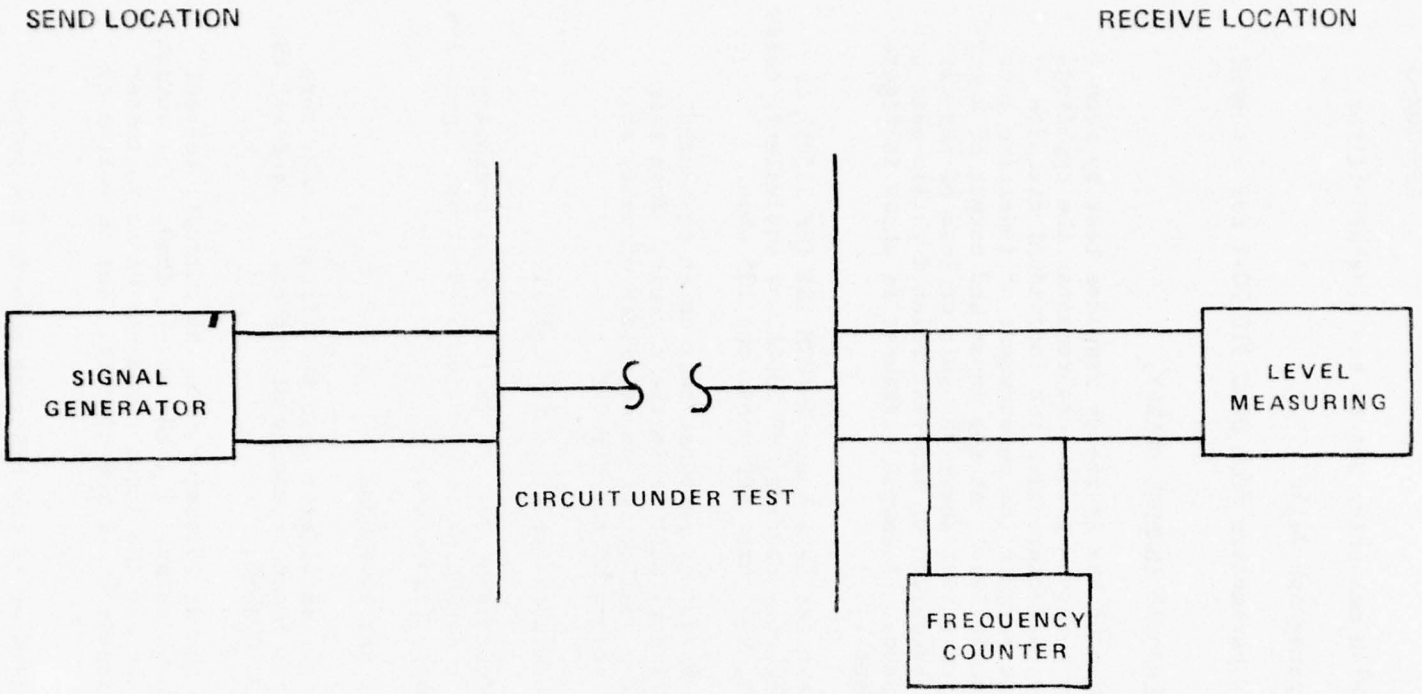


Figure 2-13. Frequency response test configuration.

(6) Connect the output of the oscillator to the input of the circuit under test and monitor the input with the ac voltmeter in the bridging mode. If the level at the input changes more than ±0.5 dbm the input impedance should be checked.

(7) Disconnect the oscillator from the input of the ac voltmeter.

(8) Terminate the output of the circuit to the input of the ac voltmeter.

(9) Connect the frequency counter in the bridging mode, across the input of the ac voltmeter.

NOTE: The frequency counter is used at the receive location to expedite testing since verbal coordination is not necessary.

(10) At the receive location, measure the level of the 1 kHz signal from the send location.

NOTE: If the measured level at the receive location differs by more than ±1 dbm0 from the measured input level at the send location, the circuit will be realigned to proper operating levels.

(11) At the send location, slowly sweep the oscillator across the frequencies to be measured, pause at each of the test frequencies to permit the receive location to note and record the frequency and receive level.

NOTE: On circuits using SF units, do not sweep through 2600 Hz, as this may cause the SF unit to operate.

(12) Record the results on a 2-cycle semilogarithmic graph paper.

(13) The maximum deviation permitted is recorded in the technical schedules (app C).

(14) If amplitude equalizers are provided, adjust the equalizers to meet specifications.

(15) After equalizers are adjusted, the test will be performed again to insure proper circuit equalization.

d. Wideband Test Procedures. Test procedures are identical to narrowband procedures paragraph 2-12c with the following exceptions:

(1) Set the output impedance of the oscillator to 135 ohms vice 600-ohms termination.

(2) Set the input impedance of the ac voltmeter to 135 ohms vice 600-ohms termination.

(3) The standard level will be 25 kHz at 0 dbm0. If level at input changes more than ±5 dbm, the impedance should be checked.

(4) Set oscillator to standard level using 135-ohm resistor.

(5) Perform this test twice in each direction of transmission, with the WLR-5's in the circuit and the WLR-5 out of the circuit. Record the data on USACC Forms 362-R (Test), figure A-12 and USACC Form 363-R (Test), figure A-13.

NOTE: Care must be taken to insure that the output level of the oscillator does not change when switching between scales.

2-13. AT-8, ENVELOPE DELAY DISTORTION (MANUAL SWEEP).

a. General. The purpose of the envelop delay distortion test by manual sweep is to evaluate the envelope delay distortion characteristics across the bandwidth of the circuit under test. Any single frequency applied to the input of a circuit is received at the output after a finite interval of time which is absolute delay. The absolute delay may be different for each frequency. Any intelligence carrying signal is a composite of a number of frequencies having definite phase relationship to each other. When such a signal is passed through a circuit, each frequency comprising the signal may be subject to different amounts of delay through the circuit.

NOTE: Envelope delay distortion occurs because of the difference in the maximum and minimum transit time of a signal within a specified band. Delay distortion can be caused by filters, line characteristics, atmospheric conditions, radio links, and mismatches of impedance. The magnitude of the distortion is generally dependant upon the number of pieces of equipment in the transmission path. Freedom from envelope delay distortion is most critical for high-speed data transmission path. For example, 2400 BAUD data has a bit length of 0.417 milliseconds. If the delay is altered to one millisecond, the data will arrive garbled.

b. Test Equipment. Delay test set, Sierra, 340 B, or equivalent; cords and connectors.

c. Narrowband Test Procedures (refer to fig 2-14). These test procedures are for the Sierra 340B. If other equipment is used, consult the manufacturers manual or appropriate TM. Record the data on figure A-9, USACC Form 359-R (Test) and figure A-11, USACC Form 361-R (Test).

(1) Test set calibration.

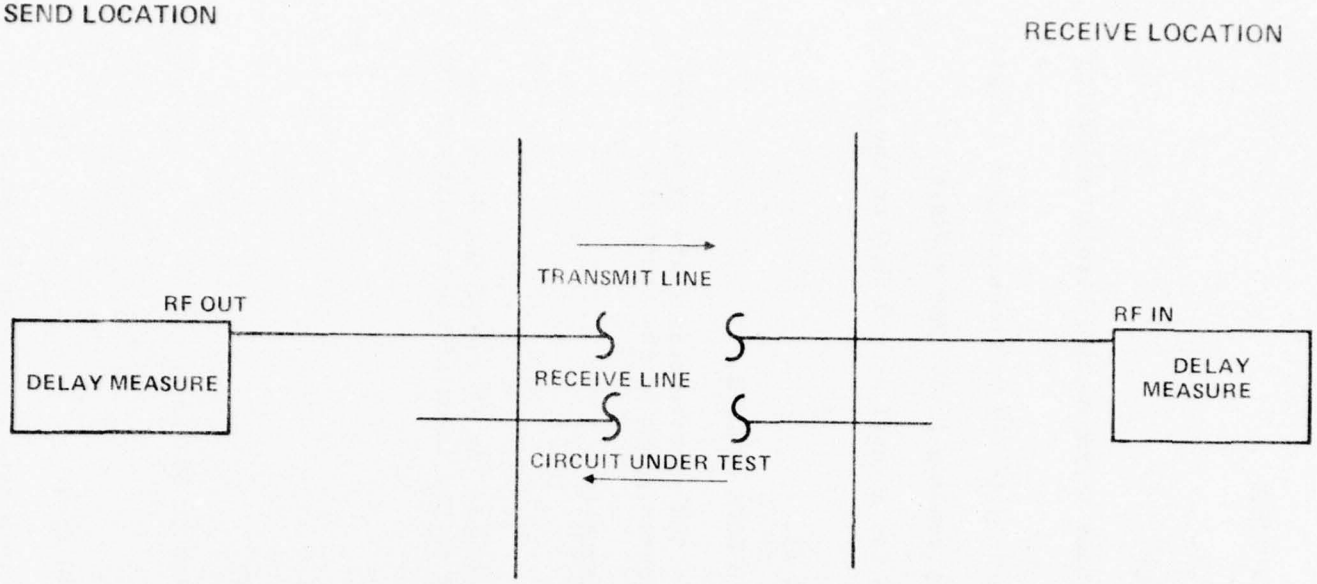


Figure 2-14. Test configuration, envelope delay (end to end without reference).

(a) Set the function switch to CHECK.

(b) Connect the RF OUT to RF IN.

(c) Turn the power switch to ON.

NOTE: Equipment requires a 2-hour warmup period before performing test.

(d) Observe that the delay reading is -40.0 microseconds + 1 digit.

(e) Observe that the frequency reading is 100 kHz + digit.

(f) Adjust "p" OUT and "p" IN for a level of -10 dbm0 on the input signal dbm meter.

(g) Set the MOD, frequency to 25.

(h) Set the function switch to RCVR or XMTR.

(i) Set the delay reading to +1000 microseconds (this is to preclude readings from crossing the zero point of the counter).

(j) The equipment is now calibrated.

(2) Procedures.

(a) At the send location, terminate the RF out of the delay test set. Connect the delay test set to the input of the circuit and complete the following steps:

1. Set Z out to 600.

2. Set sweep Hz to MANUAL.

3. Set function switch to XMTR.

4. Set the MOD frequency switch to 83 1/3.

5. Set kHz to 2 kHz.

6. Set the output level at -10 dbm0.

(b) At the receive location, terminate the output of the circuit and complete the following steps.

1. Set Z in to 600.

2. Set function switch to RCVR.

3. Set "p" for an on scale deflection of the dbm meter.

4. Set the sweep rate switch to OFF.

5. Set the MOD frequency switch to 83 1/3.

6. Set XMTR-RET REF-LOOP/E-E RCVR to RET REF.

(c) At the receive location make vernier synchronization adjustments to stop any drift in the delay reading.

(d) At the receive location, set the DMS delay at the reference of +1000 microseconds at 2 kHz.

(e) At the send location, adjust the delay test set to 100 Hz.

(f) At the receive location, record the delay on data sheet.

(g) Record the delay for 100 Hz to 3600 Hz in increments of 100 Hz (i.e., 100 Hz, 200 Hz, 300 Hz, etc).

(h) After the delay is recorded for all frequencies listed on the data sheet, plot a curve of envelope delay versus frequency on the data sheet.

(i) Compare the readings with the applicable DCA specifications.

d. Wideband Test Procedures. These test procedures are identical to narrowband procedures paragraph 2-13c with the following exceptions.

(1) Set the Z out of the delay test set to 135 ohms vice 600 ohms.

(2) Use 6 kHz as the reference frequency vice the 2 kHz.

(3) Record the delay as the following frequencies: 6, 10, 20, 25, 30, 40, 46, 48, 49, 49.5, and 50 kHz, unless otherwise specified in the technical schedules. Use USACC Forms 362-R and 364-R, figures A-12 and A-14.

NOTE: The test method described is an "end-to-end" test. If a return path is available, it is easier many times to use the "end-to-end" with "return reference" method. Refer to the operators manual for detailed procedures.

2-14. AT-9, HARMONIC DISTORTION

a. General. The purpose of the harmonic distortion test is to measure and evaluate the amount of harmonic distortion in a circuit or equipment by measuring the level of harmonically-related frequencies produced when a single frequency signal is transmitted through the circuit. This procedure permits the measurement of total harmonic distortion produced by audio frequency signals sent over a circuit. When a signal is transmitted through a circuit and no distortion of the signal occurs, the signal at the output of the channel contains only the original frequency transmitted. But if distortion occurs in the channel, new frequencies are produced which are harmonically-related frequencies and relative to the level of the fundamental signal. (A distortion conversion chart is shown in table 2-1.) Record the data on USACC Form 365-R (Test),figure A-15.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B), or equivalent; wave analyzer, HP 302A, or equivalent; balance/unbalance transmitter, HP 11005A, or equivalent; harmonic distortion analyzer, HP 334A, or equivalent; cords and connectors; resistors, 900 ohms, 600 ohms, and 135 ohms.

c. Narrowband Test Procedures (refer to fig 2-15).

(1) Make sure the circuit under test is in its normal operating condition.

(2) At the send location, before connecting the oscillator into the circuit, terminate the oscillator in 600 ohms which matches the circuit input impedance.

(3) Set the oscillator to a level of 700 Hz at 0 dbm0.

(4) Disconnect the oscillator from the 600-ohm resistor, and connect it to the circuit.

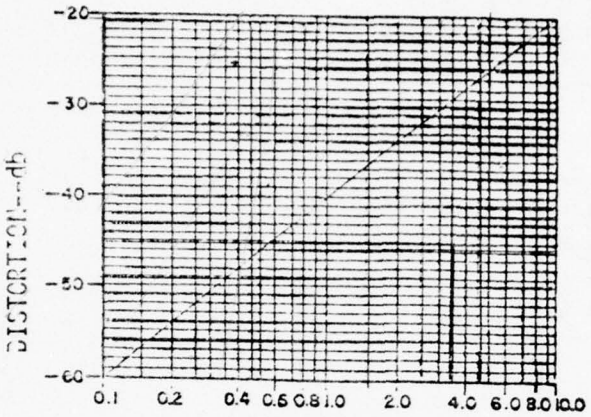
(5) Set the input impedance of the wave analyzer to match the output impedance of the circuit; connect to the circuit in the terminating mode.

(6) At the send location, adjust the output level of the oscillator to 0 dbm0 (measured by the bridged ac voltmeter) at 700 Hz.

(7) At the receive locations, measure the level of the fundamental (700 Hz), second harmonic (1400 Hz), third harmonic, (2100 Hz) and the fourth harmonic (2800 Hz).

(8) Record the levels on USACC Form 365-R (Test), figure A-15.

DISTORTION CONVERSION, db vs PERCENT



$$\text{db DIST} = 20 \log \frac{100}{\% \text{ DIST}}$$

db	PERCENT	db	PERCENT
-20	10.0	-37.5	1.35
-21	9.0	-38	1.27
-22	8.0	-38.5	1.2
-23	7.1	-39	1.12
-24	6.4	-39.5	1.06
-25	5.7	-40	1.0
-26	5.0	-40.5	0.95
-27	4.5	-41	0.90
-28	4.0	-41.5	0.85
-29	3.6	-42	0.80
		-42.5	0.75
-30	3.2	-43	0.71
-30.5	3.0	-43.5	0.67
-31	2.85	-44	0.64
-31.5	2.67	-44.5	0.60
-32	2.55	-45	0.56
-32.5	2.4	-46	0.50
-33	2.25	-47	0.45
-33.5	2.15	-48	0.40
-34	2.0	-49	0.35
-34.5	1.9	-50	0.32
-35	1.8		
-35.5	1.69		
-36	1.6		
-36.5	1.5		
-37	1.41		

Table 2-1. Conversion of db distortion to percent distortion.

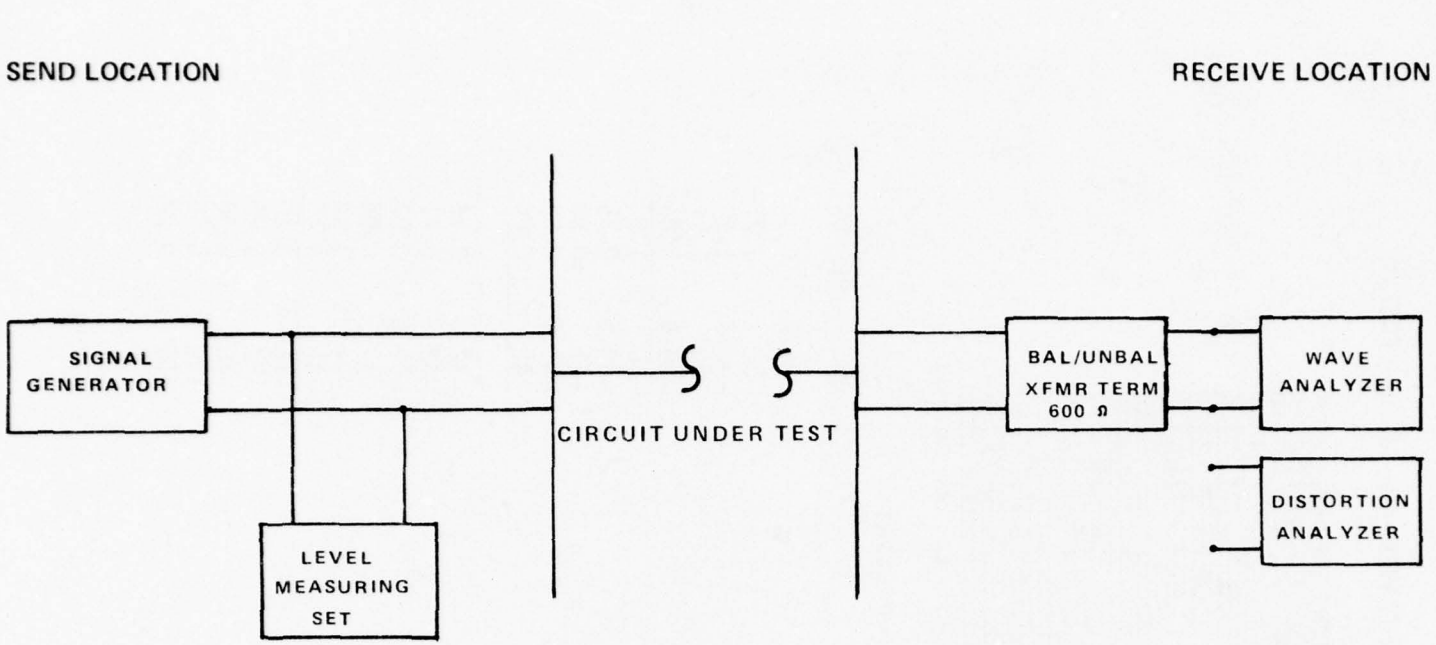


Figure 2-15. Test configuration, harmonic distortion.

d. Wideband Test Procedures. The test procedures are identical to narrowband procedures paragraph 2-14c with the following exceptions:

(1) Set the output impedance of the oscillator to 135 ohms vice 600 ohms.

(2) At the send location, before connecting the oscillator into the circuit, terminate the oscillator in 135 ohms. Set the input impedance of the wave analyzer to 135 ohms vice 600-ohms termination.

(3) Use a level of 12 kHz at -10 dbm0 vice 700 Hz at -10 dbm0.

(4) At the receive location, measure the level of the fundamental (12 kHz), second harmonic (24 kHz), third harmonic (36 kHz) and the fourth harmonic (48 kHz).

NOTE: An alternate method for measuring the total harmonic distortion is by use of the harmonic distortion analyzer. Refer to the operators manual for operating instructions. To investigate any distortion values which are out of specification, use the wave analyzer.

2-15. AT-10, FREQUENCY TRANSLATION.

a. General. The purpose of the frequency translation test is to measure the frequency translation of a test tone when transmitted through a circuit. Frequency translation is the change in receive frequency as compared to the transmit frequency. Record the data on USACC Form 366-R (Test), figure A-16.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B), or equivalent; test set frequency counter, HP 5300A, or equivalent; cords and connectors.

c. Narrowband Test Procedures (refer to fig 2-16).

(1) Insure that circuit under test is in its normal operating condition.

(2) At the send location, before connecting the oscillator into the circuit, calibrate it to a frequency 1 kHz at -10 dbm0.

(3) Connect the frequency counter in the bridging mode across the output of the oscillator.

(4) Measure the output of the oscillator to insure a standard frequency of 1 kHz at -10 dbm0.

(5) At the receive location, calibrate the voltmeter and connect it into the circuit.

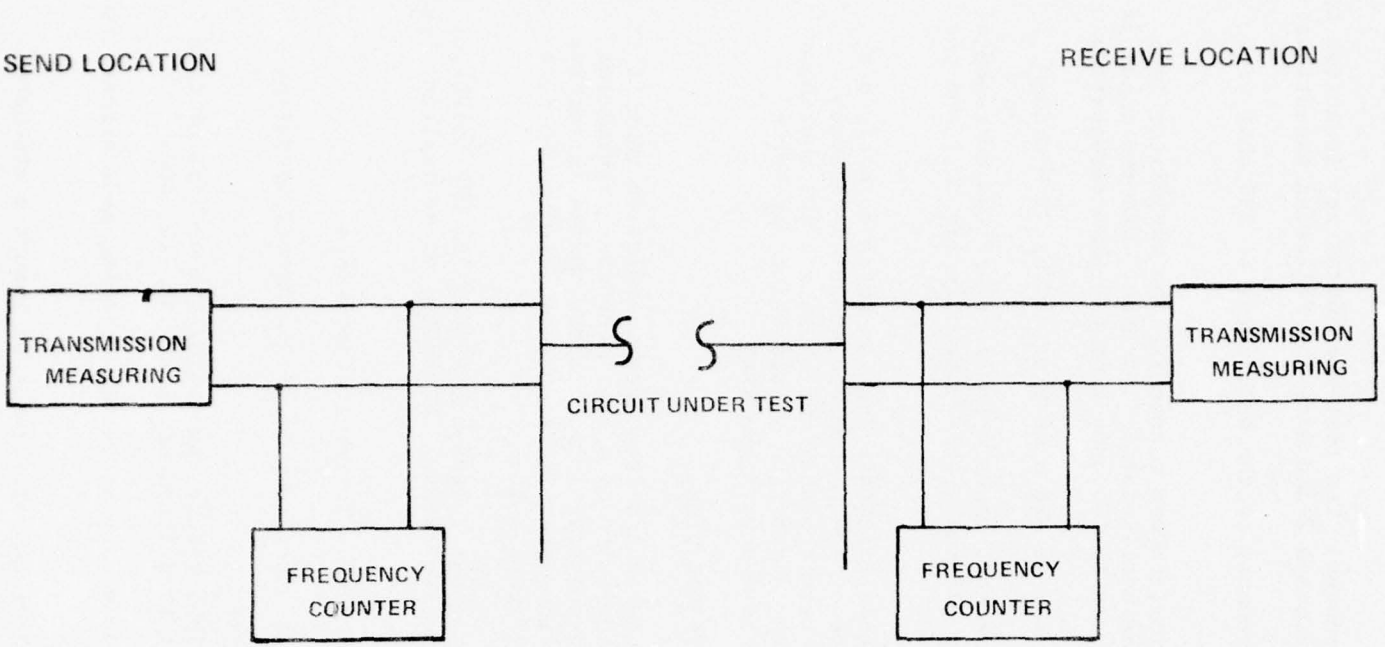


Figure 2-16. Frequency translation test configuration.

(6) At the send location, measure the transmit frequency.

(7) At the receive location, measure the receive level and frequency for a period of 10 seconds.

(8) Record the transmit and the receive frequency on the data sheet.

(9) Calculate the frequency translation using the following formula. Frequency Translation (Hz) = Transmit Frequency - Receive Frequency.

d. Wideband Test Procedures. The test procedures are identical to paragraph 2-15c with the following exceptions.

(1) Set the impedance of all test equipment to 135 ohms vice 600 ohms.

(2) Use standard frequencies in this test procedure of 25 kHz at 0 dbm0 vice 1 kHz at -10 dbm0.

2-16. AT-10A, FREQUENCY TRANSLATION (OSCILLOSCOPE METHOD).

a. General. The purpose of the frequency translation test is to evaluate the frequency translation of a 1 kHz test tone transmitted through a voice frequency channel. This method uses only a square wave source and an oscilloscope and measures translation down to 0.01 Hz (beyond the accuracy of most frequency counters). Record the data on USACC Form 367-R (Test), figure A-17.

b. Test Equipment. Oscilloscope, Tektronix 475, or equivalent; attenuator, HP 350D, or equivalent; balance/unbalance transformer, HP 11005A, or equivalent; cords and connectors.

c. Test Procedures. (Refer to fig 2-17 and 2-18.)

(1) Disconnect both input and output of circuit under test from the signal source and terminal equipment.

(2) Take the 1 kHz square wave output of the oscilloscope and adjust to -10 dbm +0.5 dbm measured across the output of the balance/unbalance transformer.

(3) On the receive end, adjust the control of the oscilloscope for a display of approximately 5 cycles of the resulting waveform.

(4) To measure the translation frequency, count the time required for the perturbation (fig 2-18) to move through a set number of cycles. The number of cycles counted will depend on how fast the perturbation is moving.

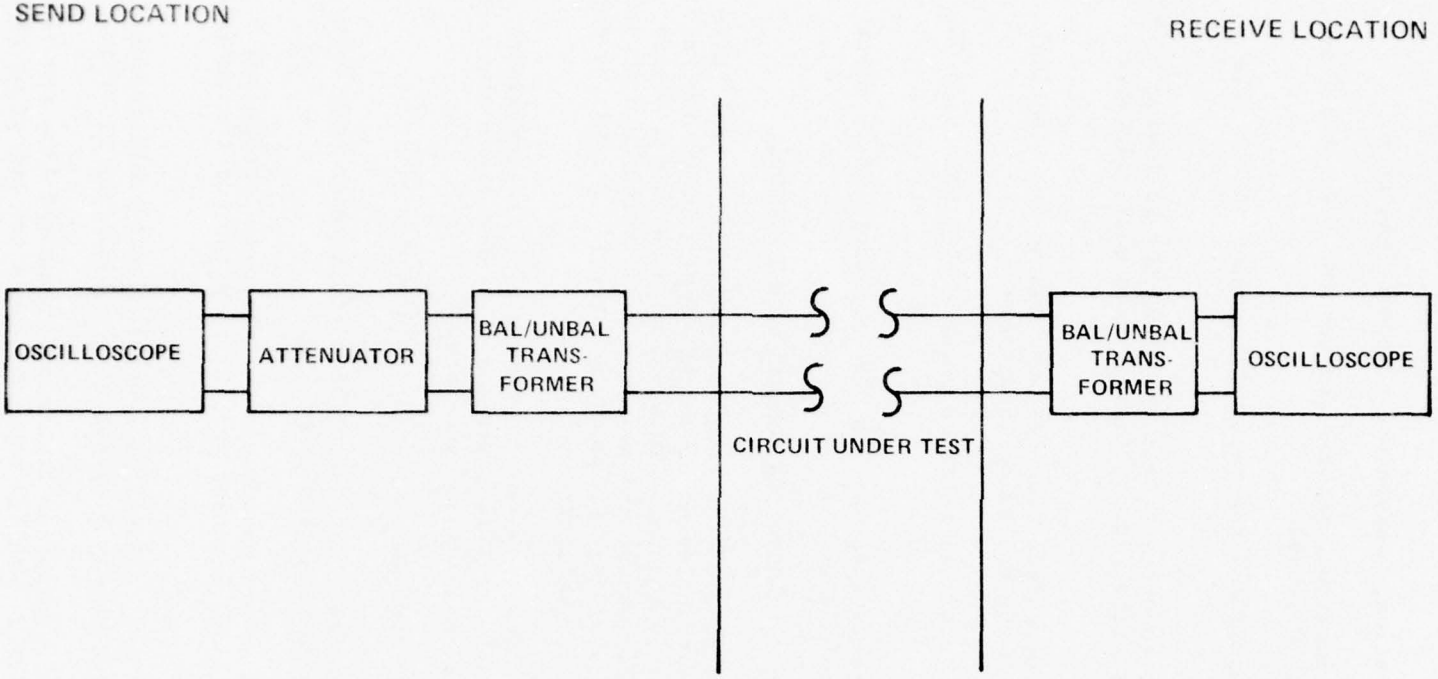
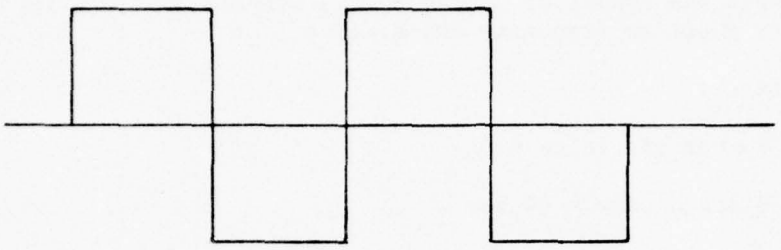
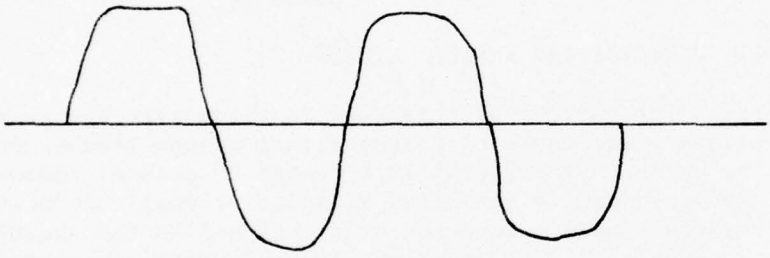


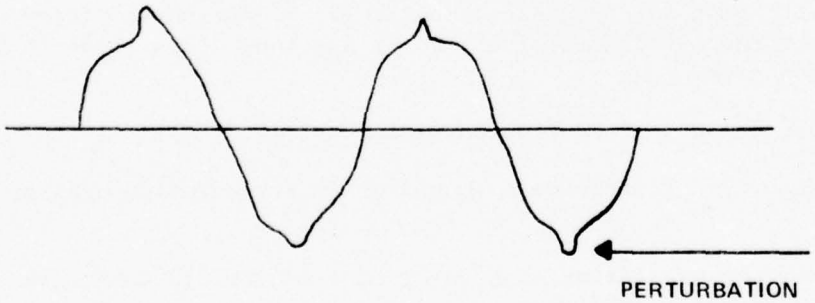
Figure 2-17. Test configuration, frequency translation (oscilloscope method).



INPUT SIGNAL



OUTPUT SIGNAL WITHOUT FREQUENCY TRANSLATION



OUTPUT SIGNAL WITH FREQUENCY TRANSLATION

Figure 2-18. Example frequency translation (scope method).

(5) Divide the number of cycles by the elapsed time and record it on the data sheet as frequency translation.

Example:

Number of cycles = 5

Elapsed time = 60 sec

$$\text{Frequency translation (Hz)} = \frac{\text{number of cycles}}{\text{elapsed time (sec)}}$$

$$= \frac{5}{60}$$

$$= 0.083 \text{ Hz}$$

2-17. AT-11, PHASE JITTER (METER METHOD).

a. General. The purpose of this test is to measure the spurious phase variations of a single frequency signal transmitted through a circuit. The phase of the signal is affected by channel induced phase noise. Phase noise can be generated by additive amplitude noise as well as incidental phase modulation of the signal in the channel. The resultant phase noise is called phase jitter. Occasional abrupt changes, or hits, can occur. Hits are large values of a spurious phase of short duration. Record the data on USACC Form 368-R (Test), figure A-18.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B) or equivalent; test set frequency counter, HP 5300A; phase jitter meter, Nekimian, 48A3-1, or equivalent; cords and connectors; 135- to 600-ohm transformer.

c. Narrowband Test Procedures (refer to fig 2-19).

(1) The circuit under test should be in its normal operating condition.

(2) Set the oscillator to a level of 1 kHz at -10 dbm0 with an output impedance of 600 ohms.

(3) At the receive location, terminate the output of the circuit into the phase jitter meter using 600 ohms.

(4) Measure the level of the input signal to the phase jitter meter, the signal level should be within +1 db of -10 dbm0.

(5) Adjust the controls of the phase jitter meter in accordance with the operating manual.

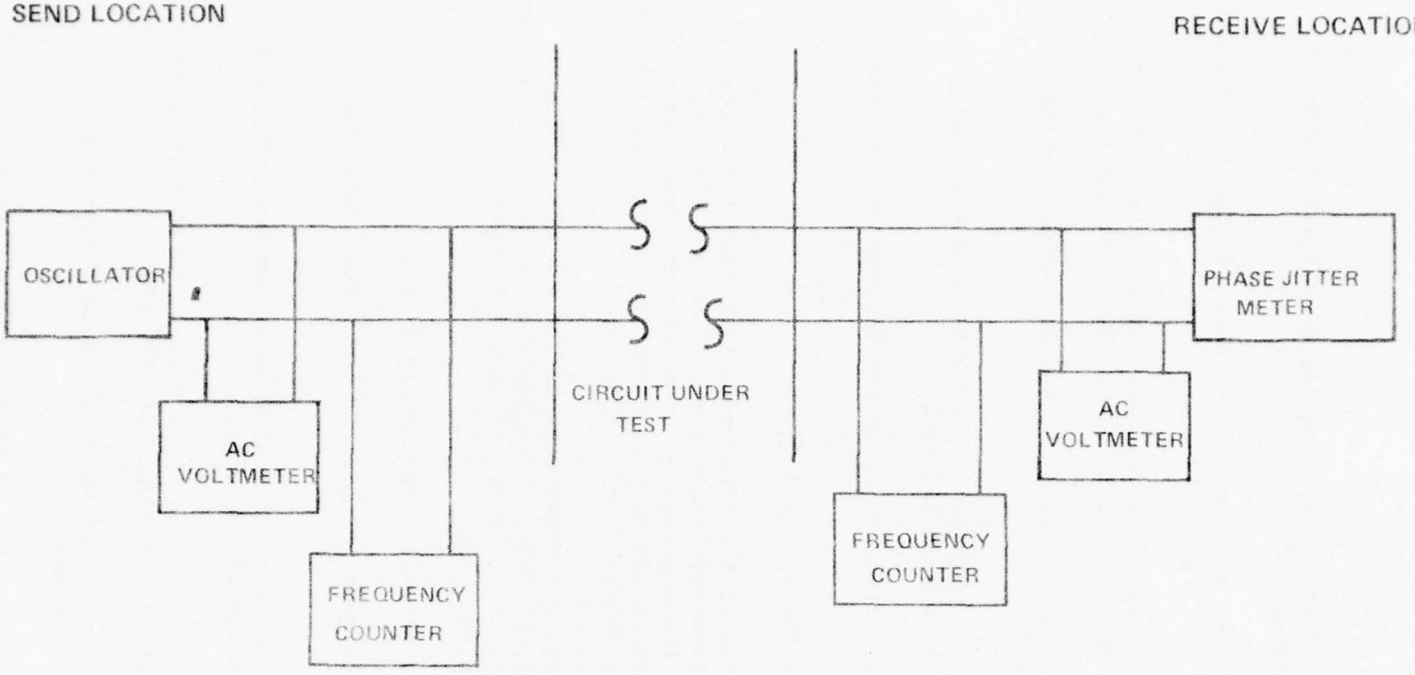


Figure 2-19. Test configuration, phase jitter and hits (narrowband).

(6) Measure the phase jitter after a period of a least 5 minutes to allow for a stable reading.

(7) Measure phase hits for a period of at least 15 minutes. Record data on USACC Form 368-R (Test), figure A-18.

d. Wideband Test Procedures (refer to fig 2-20). These test procedures are identical to paragraph 2-17c with the following exceptions:

(1) Set the oscillator to a level of 25 kHz at 0 dbm0 with an output impedance of 135 ohms.

(2) At the receive location circuit output, terminate in the 135-ohm side of the 135- to 600-ohm transformer.

(3) Terminate the phase jitter meter in the 600-ohm side of the transformer.

2-18. AT-12, INTERMODULATION DISTORTION.

a. General. The purpose of the intermodulation distortion test is to measure the two tone intermodulation distortion in a circuit. Intermodulation distortion is the degradation of a complex signal caused by non-linear characteristics at one or more points along the circuit path. Record data on USACC Form 369-R (Test), figure A-19.

b. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B), or equivalent; wave analyzer, HP 302A, or equivalent; cords and connectors; resistors, 200 ohms 1 percent (3 each), 45 ohms 1 percent (3 each), 600- and 135-ohm termination.

c. Narrowband Test Procedures (refer to fig 2-21).

(1) Insure that circuit under test is in its normal operating condition.

(2) At the send location, set oscillator to a frequency of 1 kHz at -10 dbm0 with an impedance of 600 ohms.

(3) At the send location, set the other oscillator to a frequency of 1.4 kHz at -10 dbm0 with an impedance of 600 ohms.

(4) At the receive location, calibrate the wave analyzer in accordance with the operating manual.

(5) Terminate the circuit at the receive end in 600 ohms.

(6) At the receive location, set the wave analyzer to measure 1 kHz.

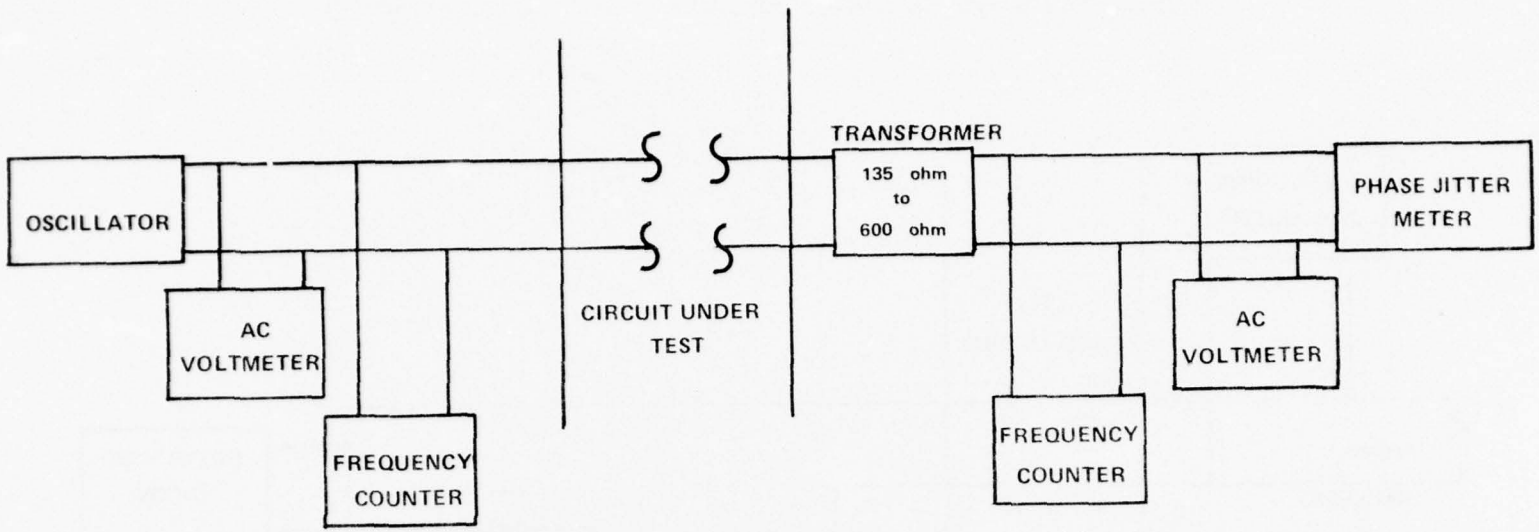


Figure 2-20. Test configuration, phase jitter and hits (wideband).

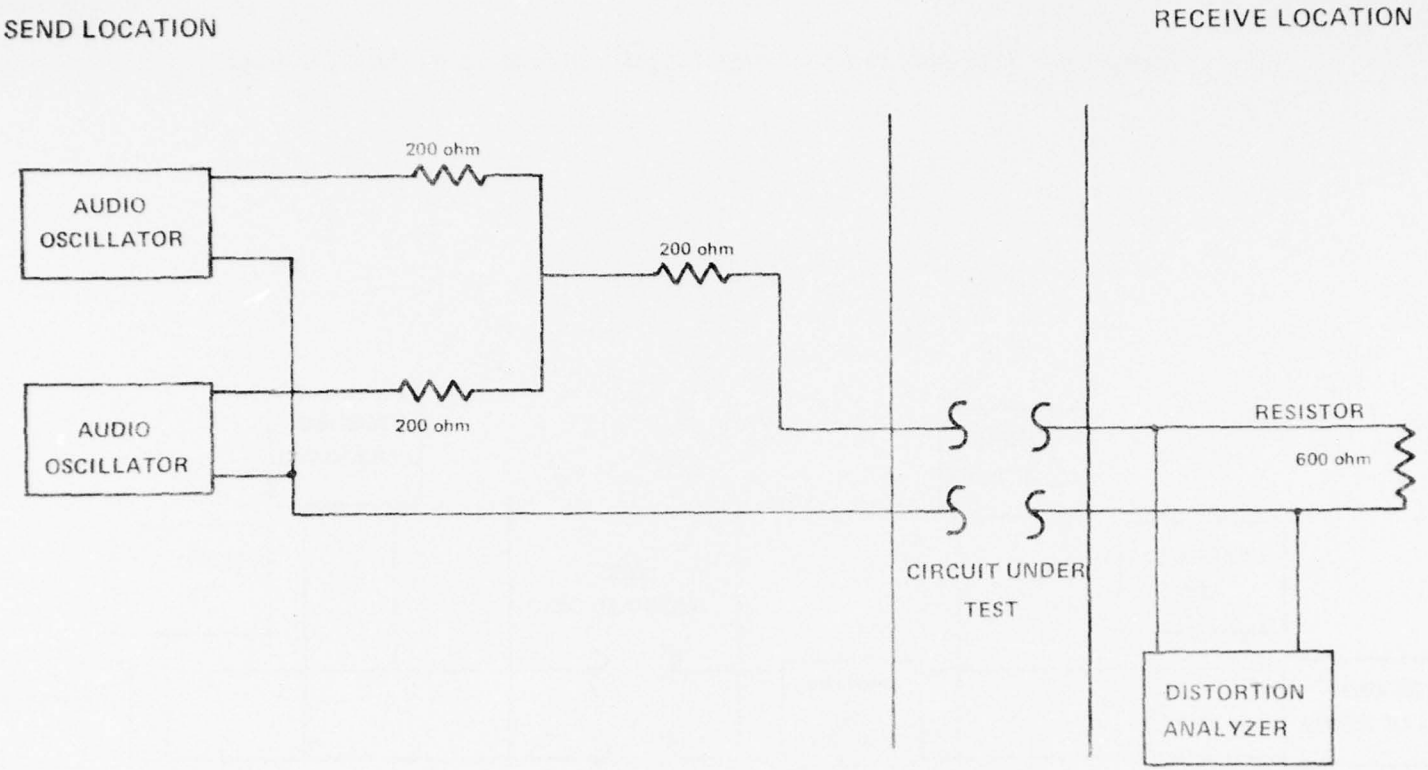


Figure 2-21. Test configuration, intermodulation distortion.

(7) Measure the 1 kHz signal in dbm and record it on the data sheet.

(8) Repeat steps 6 and 7 using the following frequencies, 400, 600, 800, 1400, 2400, and 3400 Hz.

c. Wideband Test Procedures (refer to fig 2-21). These test procedures are identical to narrowband procedures in paragraph 2-18c with the following exceptions.

(1) Set the impedance of the oscillators to 135 ohms vice 600 ohms.

(2) Use 45-ohm resistors in the resistive network vice 200-ohm resistor.

(3) Terminate the circuit with 135 ohms vice 600 ohms.

(4) Set the oscillator to a frequency of 23 kHz at 0 dbm0 vice 1 kHz at -10 dbm0.

(5) Set the other oscillator to a frequency of 24 kHz at -10 dbm0 vice 1.4 kHz at -10 dbm0.

(6) Take measurements at the following frequencies: 1, 22, 23, 24, 25, 45, 47, and 49 kHz.

CHAPTER 3

WIDEBAND ASSOCIATED TESTS

3-1. GENERAL. The AUTOSEVOCOM system tests in this chapter are designed to determine the transmission characteristics and functional capabilities of the network and to identify problem areas that can affect communications quality.

3-2. METHOD.

a. Before performing the tests, predicted performance levels should be calculated and recorded on the test data forms (app A). Those tests and the method of arriving at the predicted performance level are contained in the individual test procedures.

b. As the individual associated (A) test sequences are completed, all deviations from the expected results and specifications should be annotated on the test data forms. When possible, the specific cause of the discrepancy should be identified and corrective action should be recommended. If the necessary corrective action is too complex or time consuming to accomplish while onsite, the problem must be fully documented so that followup corrective action can be accomplished.

3-3. AT-A1, INSERTION LOSS.

a. Purpose. The purpose of this test is to measure attenuation at 25 kHz. This will be used as a preliminary check to determine if impedance irregularities in the cable are of sufficient magnitude to affect voice or data transmission. Test results will be recorded on USACC Form 370-R (Test), figure A-20.

b. General. A wire pair is essentially a resistor in series with an inductor and paralled with a capacitor. For this reason, frequency related signals will be affected by any combination of changes in parameters. Some combinations are, insulation resistance, dc resistance, or conductor breakdown which may not be reflected in resistance measurement tests. Poor splices and loose connections can add extra capacitance to the cable which can result in higher than the predicted loss at most frequencies. Occasionally, but very rarely, a condition of circuit resonance can be reached in which the circuit is an ideal transfer element due to the proper match of all parameters. Usually, however, there is a higher loss which can be compensated for by the installation of loading coils.

c. Loading. Loading a cable is a term used to indicate cancellation of the effect of capacitive loss by inserting external inductance into the circuit. The phase angle differences in inductive reactance and capacitive reactance are such that a cancellation of loss occurs

and the signal level attenuation decreases. In some cases, loading may be a solution to excessive loss that is due primarily to the length and gauge of the cable.

d. Test Equipment. Telephone test set, AN/USM 181, or equivalent; noise test set, HP 3555B, or equivalent; telephone set, TA312/PT; or equivalent; test shoes, clips, cables, and leads.

e. Specification. The loss should be within 10 percent of the typical values contained in appendix C, DCS Technical Schedules and parameters.

f. Test Procedures.

(1) Refer to the cable drawing and record correct footage (meters) of the various cable and gauge for each cable pair to be tested. Indicate in the proper column whether it is loaded or nonloaded. By reference to appendix C, calculate the estimated loss at 25 kHz. Record these losses on the test data sheet.

(2) Set up the test equipment as shown in figure 3-1 for the test tone level test. Set the test oscillator in the following configuration:

(a) Set the function switch to 600 ohms if the cable to be tested is nonloaded or 900 ohms if it is loaded. (Indicate on the data sheet which setting was used.)

(b) Set the selector switch to terminate.

(c) Set the frequency for 25 kHz.

(3) At the receive end, set noise test set in the following configuration:

(a) Selector to terminate.

(b) Function switch to 600 ohms or 900 ohms.

(c) Weighting network at VF/NM.

(d) Response switch to normal.

(e) Range to read the estimated value.

(4) Establish the talk pair using the telephone test set.

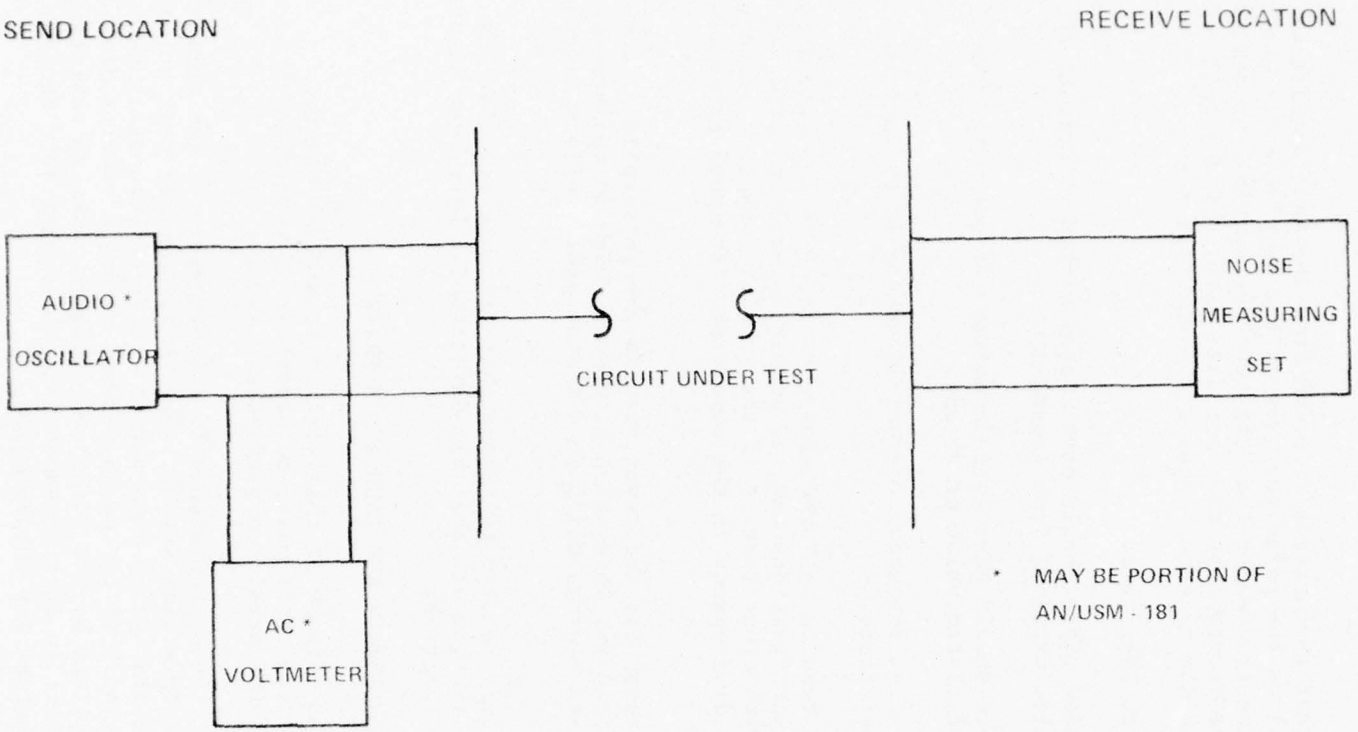


Figure 3-1. Test configuration, insertion loss.

(5) Send the test frequencies at 0 dbm from the test oscillator and read the level on the noise test set at the receive end. Use the talk pair to advise the man at the "send end" of any loss so that the information can be recorded on the test data form. If any test tone level other than 0 dbm is used, enter it on the test form.

g. Evaluation of Test Data.

(1) All nonloaded cable should have losses within 20 percent of the calculated value obtained from appendix C.

(2) Loaded cable should have loss deviations of not more than 20 percent of the calculated value at 25 kHz.

(3) Deviations from the above reflect impedance irregularities or low insulation resistance.

(4) Record the results as "preliminary." Identify the reason for failure to meet specifications and, if possible, have it corrected before proceeding with other tests. If the problem cannot be corrected, fully explain the discrepancy in the report and recommend corrective action.

(5) Possible causes for incorrect results are poor splices, corroded or loose terminals, insulation breakdown, high dc resistance, and incorrect cable drawings which do not accurately reflect distance, gauge types, etc.

(6) Check the test results to insure that all data calculations are complete and accurate and that all deficiencies have been identified for corrective action.

3-4. AT A2, DC RESISTANCE AND INSULATION RESISTANCE.

a. Purpose. The purpose of this test is to measure the dc resistance of selected cable pairs to ascertain if the cable is performing at or near the predicted performance level.

b. Resistance. The dc resistance is a measurement of the total passive resistance in a wire system. The measurement of this parameter is important since dial pulse information cannot be accurately sent from point A to point B if the dc resistance causes a voltage drop in excess of that required by the telephone exchange. The dc resistance also becomes critical in data transmission, since many data centers use trains of dc pulses for transmission.

(1) The passive resistance of a wire is influenced by temperature, metal content, impurities in manufacture, and degradation through age. Circuits of great length will have contributing factors such as splices

and terminal connections, which can increase the resistance of the wire system. If a wire is old and has been subjected to severe environmental conditions or severe flexing, crystalization can occur which lowers the conductivity or increases resistance. The most common causes for deficiencies in a wire system are poor splices and bad connections.

(2) Measurement of the insulation resistance will provide an indication of electrical separation between conductors. The higher the resistance between conductors, the lower the level of crosstalk.

(3) The insulation resistance of a wire depends on the insulation material used (dielectic strength) and the thickness of the material. In paper insulated conductors, age, environmental extremes, flexing, and moisture can cause lower values of resistance and a degraded cable system. In plastic type cable, the same problems arise but moisture is a much lower factor. Improper insulation and poor splices can cause insulation breakdown regardless of cable type.

c. Preliminary Test . This test should initially be performed as a preliminary test. Enter the data on USACC Form 370-R (Test), figure A-20. Once the preliminary test has been completed and all corrective action has been accomplished, the test should be performed again and the data recorded. This data should represent the final test results. If no corrective actions are taken during the evaluation, preliminary test results will be marked as final test data, and problem areas will be fully identified and documented for future corrections.

d. Test Equipment. Test desk, if available; test set insulation ZM-21/U or equivalent; multimeter AN/USM 223, or equivalent.

e. Specifications. The dc resistance shall be within 20 percent of the calculated values. In addition, no pair shall exceed the maximum recommended values for proper operation of telephone equipment. Any pair that exceeds the 20 percent tolerance should be identified for further investigation and correction. Refer to appendix C.

f. Test Procedures.

(1) Establish an "orderwire" or talk pair for communications between terminals and connect the telephone test sets to the cable pair to be tested.

(2) Set up the equipment as shown in figure 3-2 for the dc loop resistance test. (If a trouble desk or test bay has a resistance bridge, this may be used in place of a multimeter.) From the data in appendix C, calculate the temperature correction, predicted resistance for the pair according to length, gauge, etc. Have the technician at the distant terminal connect the wire pair to form a continuous loop. Measure the resistance of the wire loop with the multimeter (or bridge) and record this data on the form shown in figure A-20.

NOTE: Before performing this test, calculations should be made to establish the predicted value of resistance.

(3) After completing the dc resistance test, set up the test equipment for the insulation test as shown in figure 3-3. If a shoe is not used, remove the carbon blocks and heat coils at both ends of the cable pair being evaluated. With the ohmmeter, measure the breakdown resistance of the pair from tip to ground, ring to ground, and between tip and ring. Record the test results on the form shown in figure A-20.

CAUTION: Caution all personnel to stand clear until this test is completed. On completion of the test, short the pair to drain any capacitive charge that may build up.

g. Evaluation of Test Data.

(1) DC resistance. If resistances of the pairs are not within 20 percent of the calculated value, mark the test results "preliminary" and inform the wire personnel. The reason for failure to meet the specification is to be identified and corrective action must be taken before proceeding with further tests on this cable pair unless the fault cannot be corrected immediately. If corrective action cannot be taken, make sure that an appropriate recommendation regarding necessary corrective action is included in the final report with supporting documentation. Possible causes for the pair not to meet the standard are poor splices, loose connections at terminals, corrosion of wire at access areas, and crystalization of metal wire.

(2) Insulation resistance. If the cable serves a nonessential service area exclusively, a reading of 50 percent of the predicted value is acceptable. Contributing factors to poor test results are poorly insulated splices, moisture in cables (usually associated with paper insulated cables), and dielectric breakdown of insulation material. Cable used for the data transmission must meet specifications for insulation resistance.

(3) Corrective action. Any individual pair that breaks down during the test should be referred to outside plant personnel for corrective action. If corrective action cannot be taken promptly, insure that appropriate recommendations regarding corrective action are included in the final survey report, with supporting documentation.

3-5. AT-A3, STATION GROUND MEASUREMENT.

a. General. The purpose of this test is to determine by using a null balance earth tester the resistance of the station grounds in a cable distribution system. An adequate station ground and ground distribution system provides a common electrical reference point for

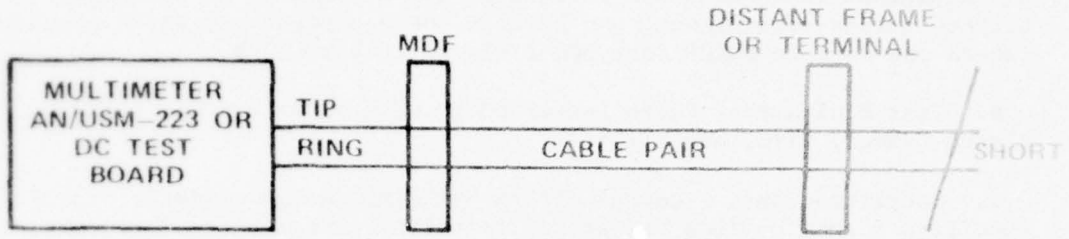


Figure 3-2. DC loop resistance test.

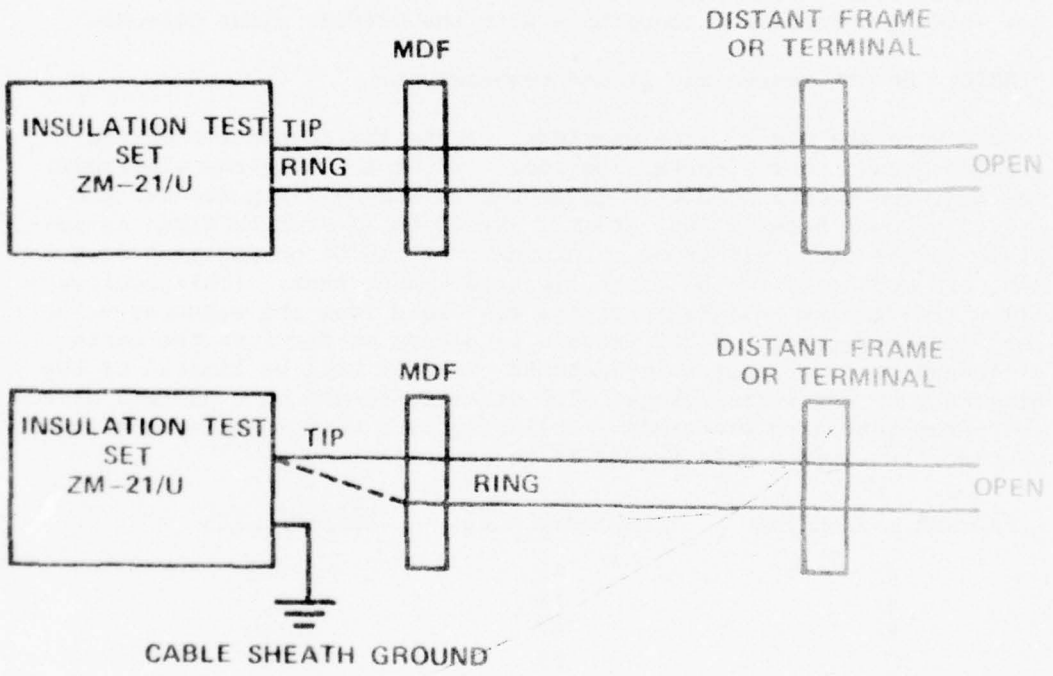


Figure 3-3. Cable insulation resistance test.

all equipment in an area and eliminates any difference in potential between pieces of equipment and between the equipment and earth ground. Record the data on USACC Form 300-R (Test), figure A-33.

b. Test Equipment. Earth tester 63220 with accessory kit 63579, sledge hammer, wire, and clips.

c. Specifications. Central office building design criteria usually specifies 5 ohms or less resistance to earth for telephone equipment.

d. Test Procedures.

(1) The station ground resistance test should be performed at each terminal location that was evaluated during previous test sequences. At protected terminals there usually will be a station ground in the building. If this can be located, it is preferable to use test setup A, as shown in figure 3-4.

(2) At unprotected terminals use test setup B as shown in figure 3-4; the cable sheath should be used. On cables where the sheath is not readily accessible, coordinate with the outside plant personnel.

NOTE: Do not remove any ground connections.

(3) With the aid of site drawings, locate the connection of the station ground to the earth electrode. After locating the electrode, the test instrument should be connected as shown in figures 3-5 and 3-6. The null balance earth tester should be located as close as possible to the earth electrode. Terminals P1 and C1 on the test instrument are connected to the earth electrode under test. (This configuration removes the resistance of the test lead from the measured value.) The first reference rod "C2" should be placed as far from the earth electrode as practical; this distance probably will be limited by the geography of the surroundings. The distance should be a minimum of 100 feet from the earth electrode. Following is a useful guide to P2 and C2 placement when a grid ground is to be tested.

DIAGONAL DIMENSION	DISTANCE E-P2	DISTANCE E-C2
4	62	100
6	78	125
8	87	140
10	99	100
12	105	170
14	118	120
16	124	200
18	130	210
20	136	220
40	198	320

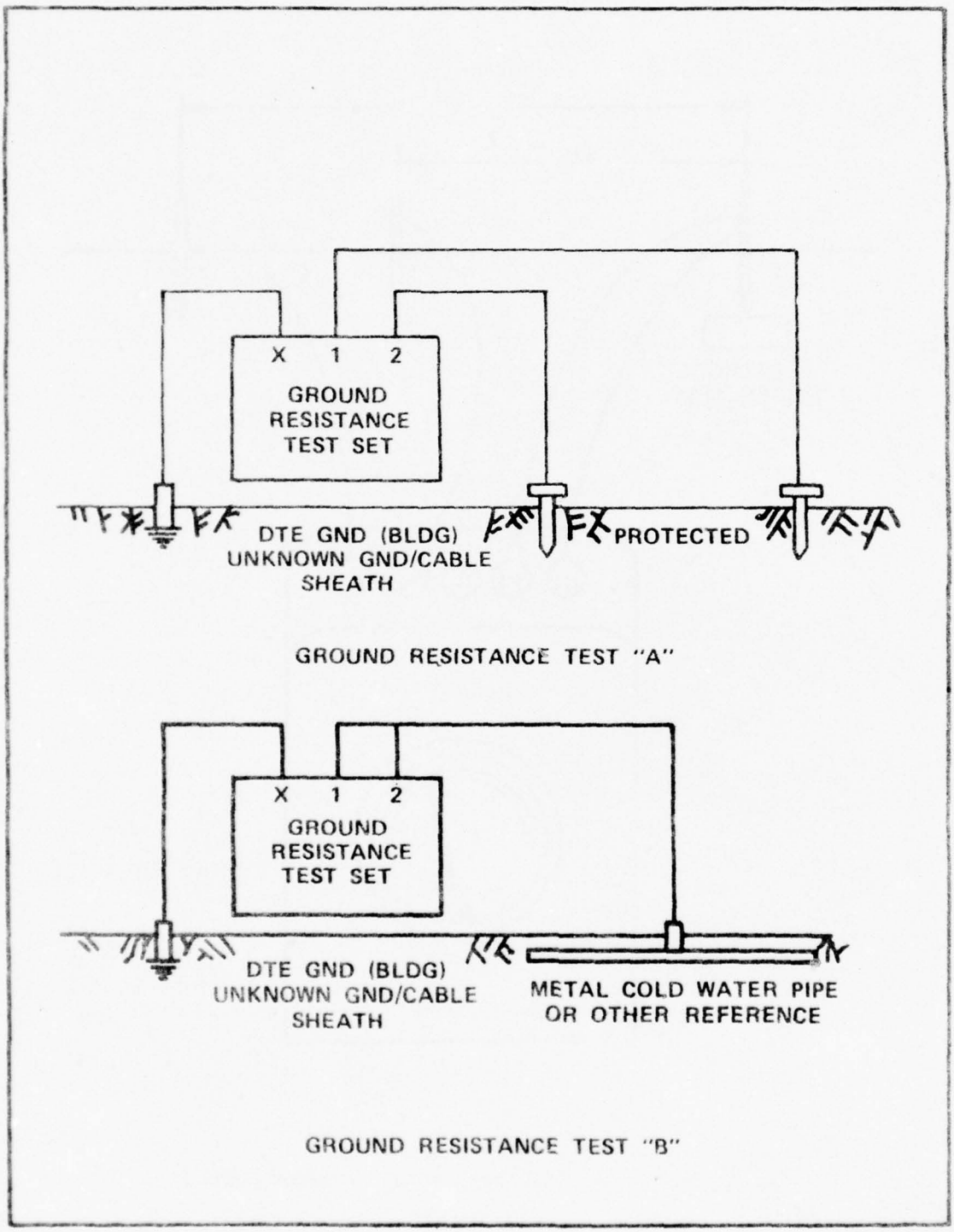


Figure 3-4. Station ground resistance tests.

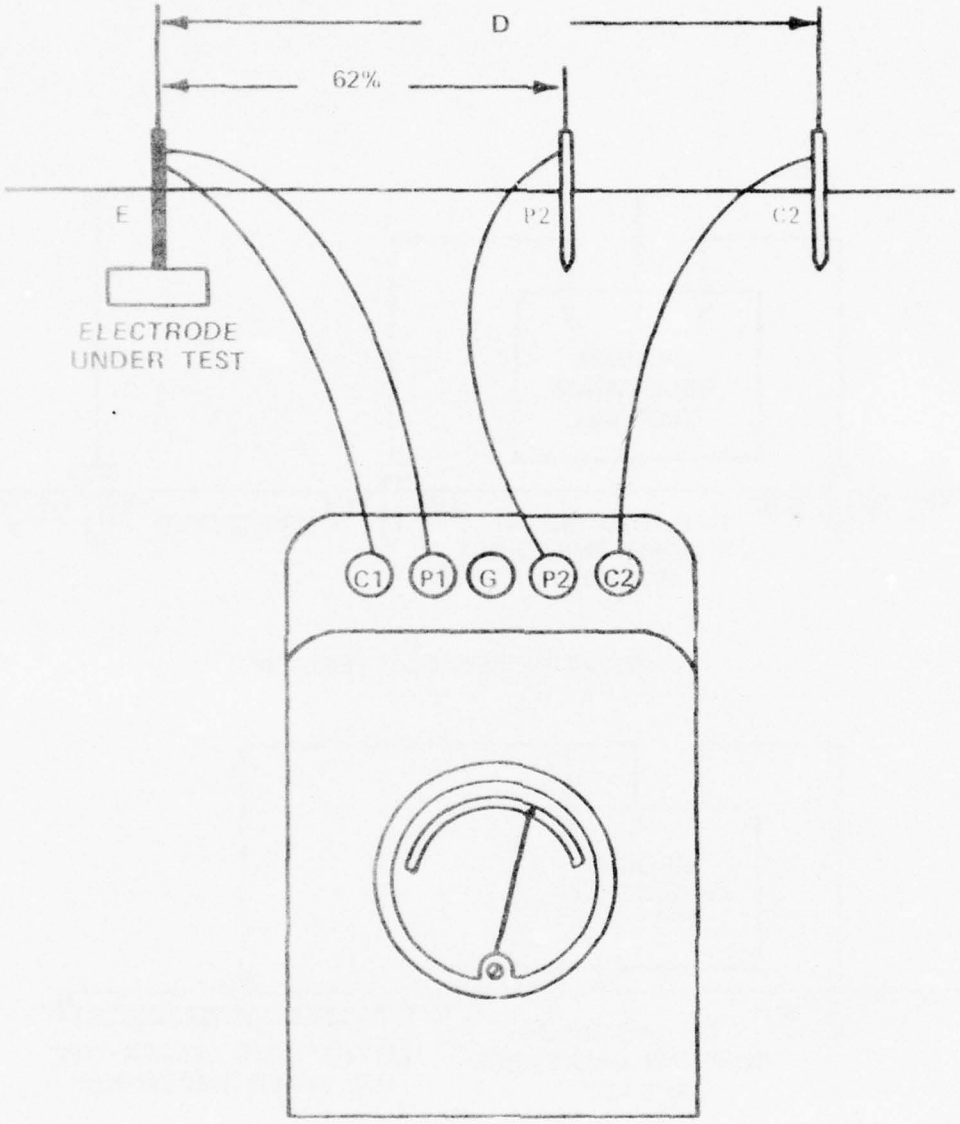


Figure 3-5. Test equipment setup, station ground.

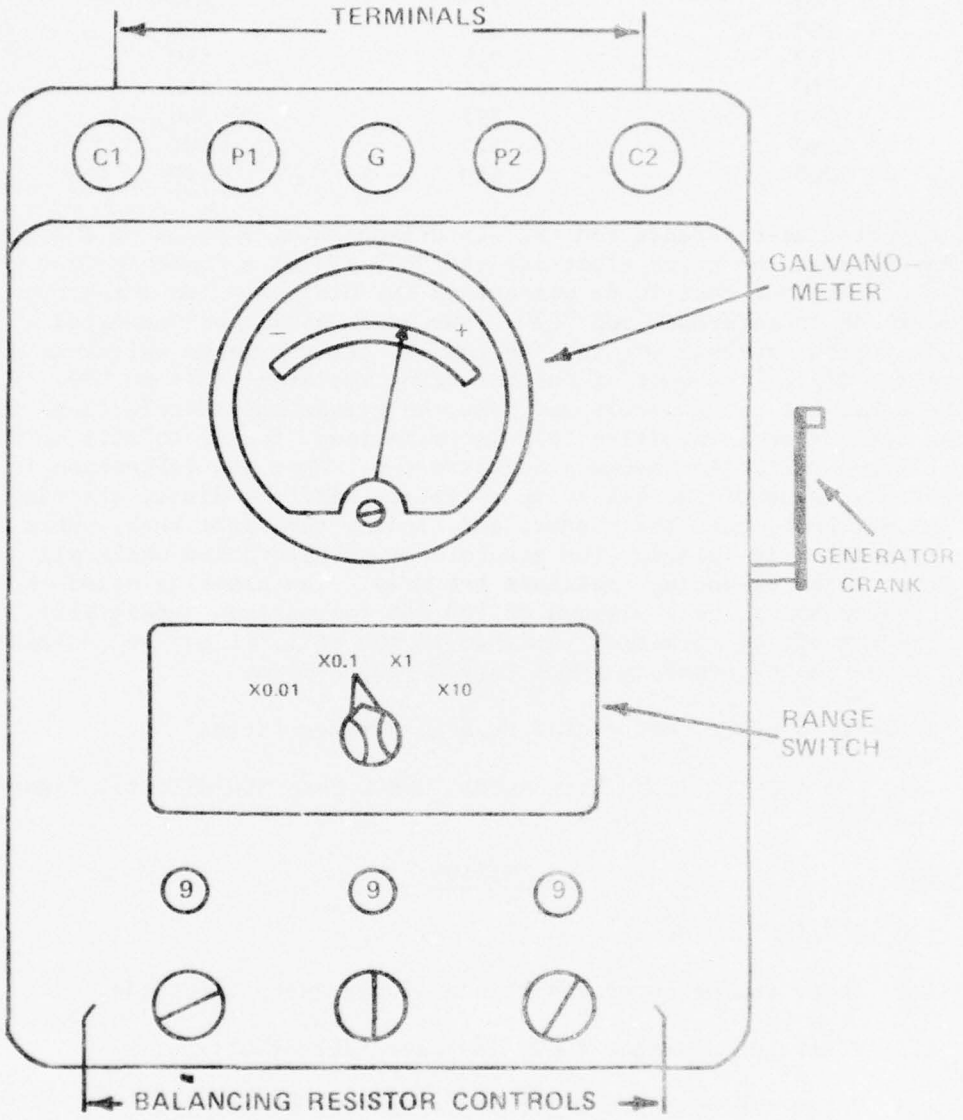


Figure 3-6. Equipment controls, station ground.

DIAGONAL DIMENSION	DISTANCE E-P2	DISTANCE E-C2
60	242	390
80	279	450
100	310	500
120	341	550
140	366	590
160	397	640
180	422	680
200	440	710

The potential-reference rod "P2" is driven in at a point on a straight line between the earth electrode and "C2" and at a distance from the earth electrode that is 62 percent of the distance from the earth electrode to reference rod "C2". The leads should be connected to the rods and instrument. On the instrument, set the range switch to x0.01 and the digital readout of the balancing resistor dials to 999. Turn the generator crank slowly and note the galvanometer deflection. If the deflection is positive (+), increase range factor to x0.1 or higher until the deflection becomes negative (-). When the deflection is (-), decrease value of the balancing resistor, digit by digit, starting with the left knob, then the center, and finally the right knob, until the galvanometer is nulled. The generator must be cranked while all adjustments on the balancing resistors are made. The cranking speed of the generator should be a minimum of 160 rpm for maximum sensitivity. To avoid the effects of stray currents in the soil, it may be necessary to increase the cranking speed to 200 rpm or more.

Resistance under test = dial reading x range factor

(4) Complete the test data sheet, USACC Form 300-R(Test), figure A-33, as follows:

BLOCK	ENTRIES

1.0 STATION GROUND.

1.1 Enter the measured resistance of the earth electrode.

1.2 Enter the distance E-C2; indicate feet or meters.

1.3 Enter the distance E-P2; indicate feet or meters.

1.4 Describe the station ground commenting on soil type, soil condition, condition of earth electrode assembly, marking, type of connections, station ground distribution box, provision for watering.

1.5 Enter the size of the ground conductor (i.e., -1000 MCM, 4/0 AWG, 2 AWG, 3" x ¼" plate, 2" x 10 GA Cu strap, braid).

1.6 Enter the type of chemical treatment used (i.e., none, magnesium sulphate, copper sulphate, sodium nitrate, chloride, sodium chloride, iron sulphate, potassium nitrate, ammonium nitrate, activated charcoal, coke).

2.0 INTERIOR GROUND DISTRIBUTION.

2.1 Describe the interior ground distribution commenting on condition, marking, insulation, connectors, and branching.

2.2 Enter size of the interior ground feeder (i.e., -750 MCM, 4/0 AWG, 2 AWG).

2.3 Enter the size of the rack ground feeder (i.e., -2 AWG, etc).

3.0 EXTERIOR GROUND DISTRIBUTION.

3.1 Describe the exterior ground distribution commenting on condition, marking, method of connection and bonding, and list major items connected.

3.2 Enter size of the exterior ground feeder (i.e., -500 MCM, 2/0 AWG, 2 AWG).

3.3 Enter the size of the exterior ground distribution conductor (i.e., 2/0 AWG, 2 AWG).

e. Evaluation of Test Data. Note any terminals with readings of more than 5 ohms resistance and, if possible, identify the problem area. Corrective action should be taken while the team is onsite, if this is not possible, appropriate recommendations should be included in the final report.

CHAPTER 4

CIRCUIT EQUALIZATION

4-1. GENERAL. This chapter provides circuit equalization procedures which may be used to optimize the worldwide AUTOSEVOCOM network equipment. Included is tutorial information to familiarize personnel with the envelope and amplitude delay equalizer CN-1234/GCC and the wideband loop repeater WLR-5.

4-2. METHOD. Based on the availability of test and equalization equipment, the most practical method of testing and equalization will be performed. The AUTOSEVOCOM technical evaluation team chief will decide which test procedures will be used in the equalization process after considering test equipment availability, circuit configuration, availability of return reference path, orderwire availability, and other pertinent circumstances.

4-3. CIRCUIT EQUALIZATION, NARROWBAND.

a. General. Relative envelope delay is the lagging behind of some frequencies in relation to other frequencies. Distortion is caused by relative delay, not absolute delay. The time delay or frequency range must be delayed equal time intervals to equalize the circuit. Those frequencies that lag behind others cannot be made to catch up to those that are more advanced but the relative delay, the delay between the frequencies, can be eliminated by delaying all frequencies to the speed of the slowest one. Thus, relative delay over the frequency range is eliminated by increasing absolute delay of each frequency in the range to the same amount. When delay is introduced by the equalizer at one of the selected frequencies, frequencies above and below that frequency are affected also. For example, delay induced at 1.8 kHz will induce a slight amount of delay on the frequencies .5 and 3.2 kHz. Progressing inward from both ends of the frequency range, the delay will increase slightly more until, at 1.5 and 2.1 kHz, the delay increases in greater amounts reaching a set peak at 1.8 kHz. Since delay is additive, delay introduced at five or six points spread across a frequency range will interact to fill the gaps between these points with sufficient time intervals to delay the entire range equally.

b. Equalizer Arrangement. The equalizers are located between the circuit patch bay and the primary patch bay (fig 4-1). The CN-1234A/GCC equalizer cannot accept signals above 0 db; and the output must be the same or less, but not more than, the input. Therefore, once the equalizer has been installed, check the levels at the circuit and primary patch bays to insure proper levels of -2 dbm at the circuit patch bay and 0 db at the primary patch bay.

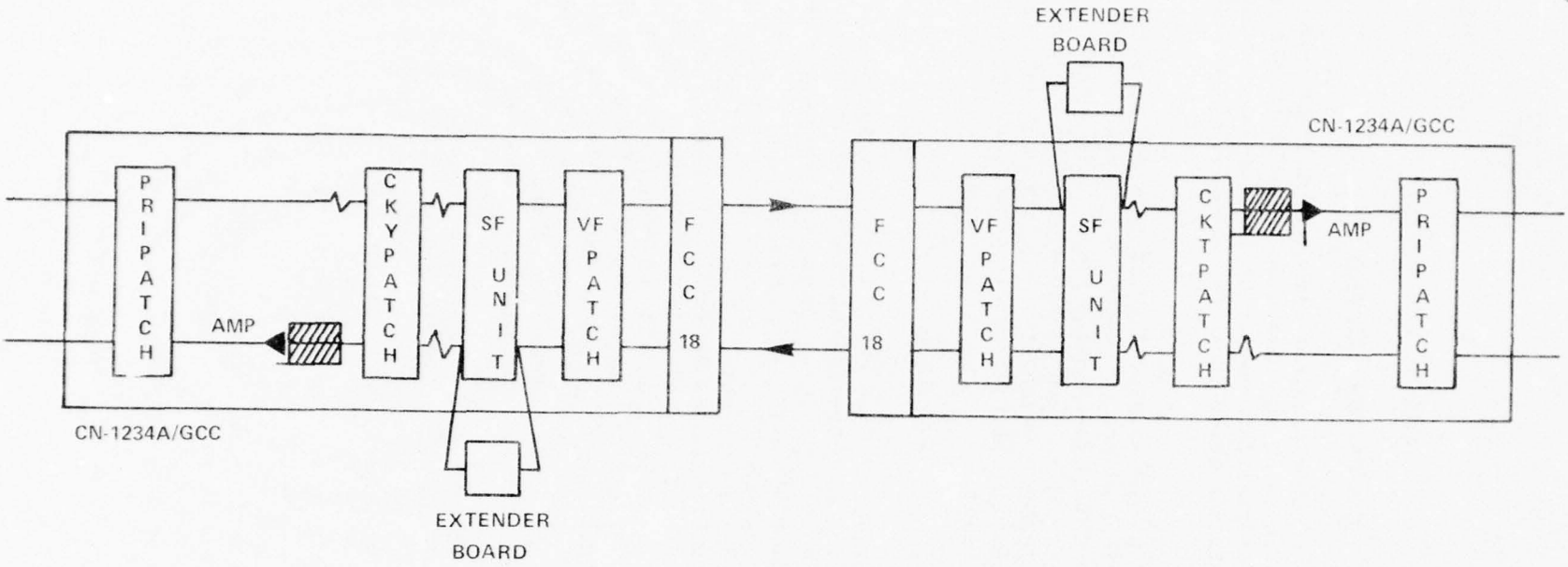


Figure 4-1. General layout.

c. CN-1234/GCC Front Panel Description. There are 12 identical sections in the CN-1234A/GCC, each contains 3 front panel controls: amplitudes, frequency, and delay. Frequency (kHz), an 11 position rotary switch, determines frequencies at which equalization will apply (fig 4-2). When the switch is in the off position, no delay equalization is applied. Delay and amplitude controls adjust the amount of delay and the amount of voltage gain applied respectively. The operation of the CN-1234A/GCC is guided by the following criteria:

(1) The delay and amplitude controls have locking mechanisms. Make sure the locking mechanisms are disengaged by rotating the outer rings counterclockwise.

(2) The first adjustment should be to obtain a desired delay versus frequency characteristic.

(3) The 12 delay sections are arranged in series or cascade so the delays are additive.

(4) From the left, the first six sections may be set to any of 10 frequencies from 0.5 to 2.3 kHz in 0.2 kHz progressions. The last six sections can be set to any of the following frequencies: 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 3.0, and 3.2 kHz (fig 4-2).

d. Test Equipment. Test set telephone, AN/USM 181 (HP 3550B) or equivalent; cords and connectors.

e. Narrowband Test Procedures (refer to fig 4-1).

(1) Disengage 2600 SF unit of receive station with a service extension board (see fig 4-1). This device is convenient for extending the signaling units for removal from their normal shelf positions for inspection, testing, and alignment of the circuit while it remains in service. The extension unit contains a jackfield for access to line, drop, and signaling leads. It is especially useful when external jackfield connections are not provided for the signaling units.

(2) Disengage locking mechanisms.

(3) Turn all DELAY controls to either MAXIMUM, MINIMUM, or MIDRANGE setting.

(4) Turn all FREQUENCY switches to OFF.

(5) Set all AMPLITUDE switches at MIDRANGE.

(a) Correcting delay distortion.

1. Read delay of entire bandwidth.

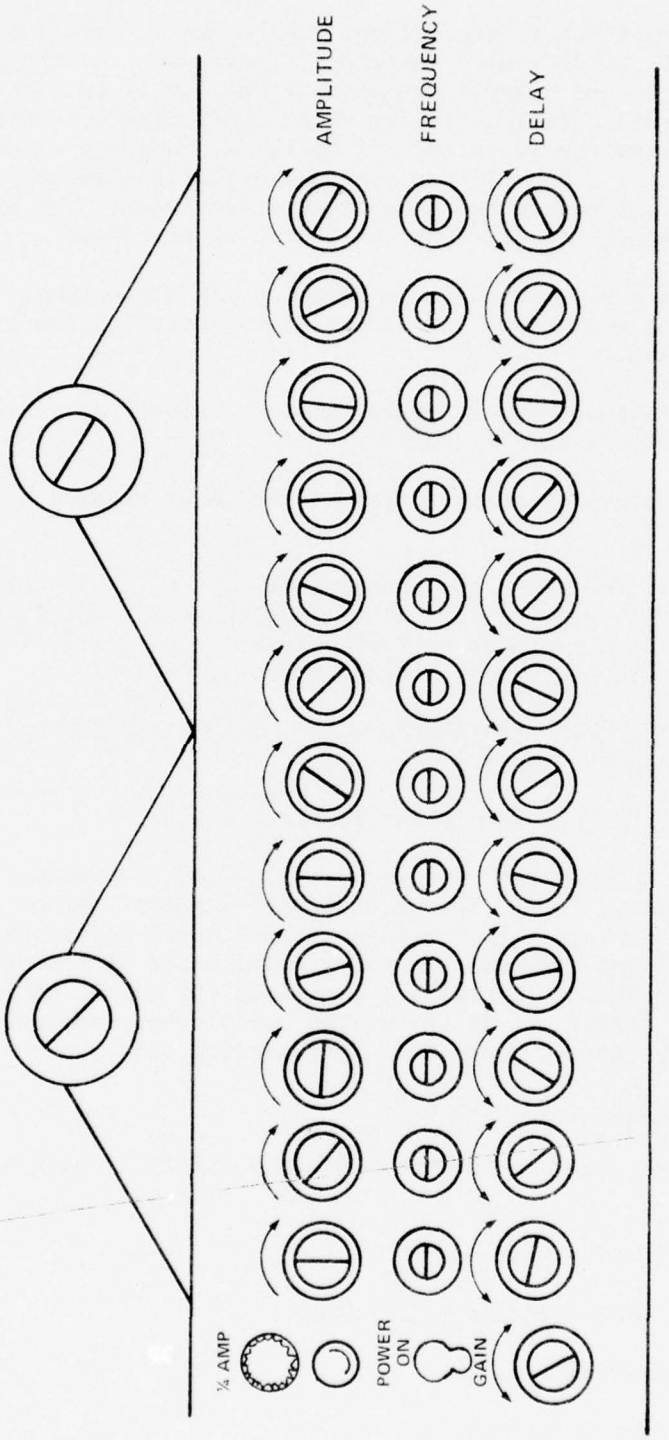


Figure 4-2. Equalizer, envelope delay, and amplitude, CN-1234A front panel.

2. Compensate first (in most cases) at midband frequencies. Settings at 1.3, 1.6, 1.9, and 2.4 are advisable.

3. The selection of frequencies and the sequence of their adjustment can be guided by the following outline:

Adjustment	11	8	5	4	3	1	7	2	6	9	10
Sequence	.5	.7	.9	1.3	1.6	1.9	2.1	2.4	2.6	2.9	3.2
Frequency kHz											

4. Correct until flattest curve is obtained. Add the least number of sections required because the addition of too many sections can cause unfavorable results.

(b) Correcting amplitude distortion.

1. Read amplitude response of entire bandwidth.

2. Only slight interaction should be experienced between amplitude compensation and delay compensation.

3. Begin amplitude correction with the frequencies having the most deviation from the average amplitude.

4. Correct until flattest response is obtained.

5. Lock control mechanisms of both DELAY and AMPLITUDE controls.

4-4. WIDEBAND CIRCUIT EQUALIZATION.

a. General. These procedures will be used to equalize a wideband AUTOSEVOCOM circuit with a WLR-5 repeater.

(1) Equalization is the result of increases to the gain of the preamplifier section of the WLR-5 repeater at the higher frequencies to compensate for the greater losses incurred in the cable as frequency is increased.

(2) The preamplifier contains six high frequency boost networks, each adjustable by means of a potentiometer located on the face of the unit (fig 4-3). Each potentiometer is numbered with the frequency band which it will adjust. Each high frequency boost network is designed to produce gain at its labeled frequency and above, but to have only small effect below the frequency.

b. Test Equipment. Test set, AN/USM-191 (HP-3550) or equivalent; test connector, WECO ED-73285-30, or equivalent; volt-ohmmeter, Simpson 313, or equivalent; test leads and connectors.

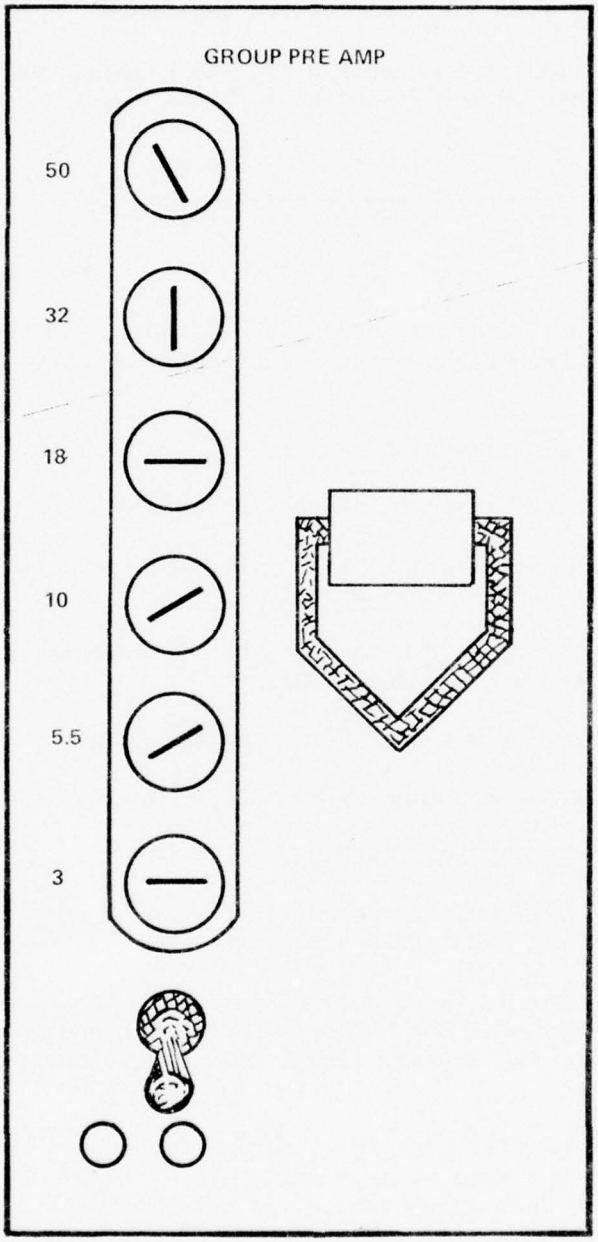


Figure 4-3. WLR-5, group preamp.

c. Specifications. Specifications will be as given in (C) TM 11-5805-620-14 (U).

d. Test Procedures. Testing will be performed in accordance with (C) TM 11-5805-620-14 (U). Record the data on USACC Form 372-R (Test), figure A-21.

CHAPTER 5

PRELIMINARY EVALUATION CHECKS

5-1. EVALUATION TEST PLAN.

a. Purpose. The purpose of this chapter is to provide guidelines for determining the reliability and quality of operation of the AUTOSEVOCOM facilities.

b. Tests to be Performed. Unless instructed in the specific check procedures outlined in this chapter or as instructed by task order, the preliminary (P) tests outlined below are to be performed on all trunks and subscribers.

TEST NO.	TITLE	FORM NO.
AT-P1	Subscriber Lines	USACC Form 370-R (Test)
AT-P2	Clear Voice Levels	USACC Form 371-R (Test)
AT-P3	Voice Quality Check	USACC Form 371-R (Test)
AT-P4	WLR-5 Conditioning Equipment	USACC Form 370-R (Test)
AT-P5	Synchronization Verification and Alarm Check	USACC Form 371-R (Test)
AT-P6	Synchronization Check	USACC Form 371-R (Test)
AT-P7	Authorized Precedence Check	USACC Form 371-R (Test)
AT-P8	Preemption Check	USACC Form 371-R (Test)

c. Evaluation and Analysis.

(1) All deviations from the listed specifications or other discrepancies are to be logged. The exact cause for failure and contributing factors are to be identified and recorded along with the efforts that were necessary to implement corrective action.

(2) When deficiencies are known before the evaluation, all possible means of identifying the contributing factors will be made and recorded. Corrective action should be taken prior to testing. If the action is dependent on outside sources (i.e., parts or other such support activity) the appropriate O&M command will be notified and corrective action will be initiated.

(3) Future capabilities of the AUTOSEVOCOM system should be considered and appropriate remarks should be listed in the final report.

5-2. AT-P1, SUBSCRIBER LINES.

a. General. The purpose of the visual inspection is to determine the general condition of the facilities. The condition is to be summarized in the final report (app B, comment section).

b. Test Equipment. None.

c. Procedures.

(1) Check all subscriber lines for cable type, gauge, from--to locations, length (ft), and routing.

(2) Verify the above information using the circuit layout record versus physical inspection.

(3) Record the above information on the data sheets, USACC Form 370-R (Test), figure A-20.

d. Test Data. Summarize all deviations that could result in improper subscriber service.

5-3. AT-P2, CLEAR VOICE LEVELS.

a. General. The purpose of this inspection is to determine the general voice level and quality.

b. Test Equipment. None.

c. Procedures.

(1) Place a routine precedence call to the associated switchboard and note the acceptability of the voice level and quality.

(2) Summarize the condition and quality of the voice level in the final report on USACC Form 371-R (Test), figure A-22.

5-4. AT-P3, VOICE QUALITY CHECK (SECURE).

a. General. The purpose of the inspection is to determine the secure voice quality.

b. Test Equipment. None.

c. Procedures.

(1) Using a subscriber KY-3 that has been tested and aligned, accomplish a secure voice quality check with the AUTOSEVOCOM Network Assessment Facility (ANAF) in accordance with DCAC 310-70-57, chapter 3, supplement 4.

(2) Record the results and summarize any severe deviations that could result in improper service on USACC Form 371-R (Test), figure A-22.

5-5. AT-P4, WLR-5 CONDITIONING EQUIPMENT.

a. General. The purpose of the visual inspection is to determine the general condition and location of the WLR-5s.

b. Test Equipment. None.

c. Procedures.

(1) Record the location and type of all WLR-5s on the appropriate data sheet. (Fig. A-21.)

(2) List the WLR-5 packages used in each configuration.

(3) Summarize the condition in the final report on USACC Form 370-R (Test), figure A-20.

5-6. AT-P5, SYNCHRONIZATION VERIFICATION AND ALARM CHECK.

a. General. The purpose of the inspection is to verify that the synchronization and alarm check systems are operating properly.

b. Test Equipment. None.

c. Procedures.

(1) Turn the equipment rack ac power off and remove the KG-13 red data output connector.

(2) Open the TSEC/KG-13 receiver card reader door.

(3) With the narrowband trunk unit (NBTU) in a loop back configuration, attempt to place the trunk into the secure mode.

(4) Observe that the KG-13 lights sequence three times, the SN-394/G is activated, and the switchboard alarm light comes on.

(5) Restore the NBTU to its normal operating state.

(6) Record the results, and summarize all deviations which would result in improper service on USACC 371-R (Test), figure A-22.

5-7. AT-P6, SYNCHRONIZATION CHECK.

a. General. The purpose of the inspection is to ascertain the condition of the synchronization sequence. Conditions are to be summarized in the final report under comments.

b. Test Equipment. None.

c. Procedures.

(1) Place the trunk in the secure mode while a maintenance technician observes the KG-13 lights.

(2) Determine the number of sequences required to obtain synchronization, and record on USACC Form 371-R (Test), figure A-22.

(3) Observe that the switchboard secure lamp flashes then becomes steady when synchronized.

(4) Momentarily depress the switchboard response button to initiate a new synchronization attempt.

(5) Repeat until five synchronization attempts have been made.

(6) Record the number of sequences required for each attempt in the comments section of USACC Form 371-R (Test), figure A-22.

5-8. AT-P7, AUTHORIZED PRECEDENCE CHECK.

a. General. The purpose of this test is to check the proper operation of precedence selection.

b. Test Equipment. None.

c. Procedures.

(1) During a period of light traffic, place a call to ANAF through AUTOVON at the highest precedence authorized the trunk.

(2) Place a call to the ANAF at the next higher precedence and observe that the call is blocked by AUTOVON.

(3) The condition is to be summarized in the final report on USACC Form 371-R (Test), figure A-22.

5-9. AT-P8, PREEMPTION CHECK.

a. General. The purpose of this test is to check the preemption circuits.

b. Test Equipment. None.

c. Procedures.

(1) With a routine precedence call to the ANAF in the secure mode, have the ANAF operator send AUTOVON preempt tones to the NBTU under test.

(2) Observe that the switchboard secure lamp goes off and the preempt lamp comes on.

(3) At the switchboard site, the preempt lamp will remain on until the trunk is returned on hook.

NOTE: At an AN/FTC-31 site, the prempt lamp will light momentarily, the trunk will automatically be placed on hook, and the subscriber connection will be terminated. The subscriber will receive an 800 Hz preempt tone from the AN/FTC-31 switch.

(4) Place a routine call (secure) to the ANAF.

(5) At the switchboard site, depress the SECORD preempt button.

(6) Observe that the preempt lamp comes on and the secure lamp goes off.

(7) All deviations which would result in improper subscriber service will be summarized in the final report on USACC Form 371-R (Test), figure A-22.

CHAPTER 6

PERFORMANCE EVALUATION

6-1. OPERATIONS AND MAINTENANCE CHECKS. Operations and maintenance checks will be included in the performance evaluation of an AUTOSEVOCOM facility to insure efficient utilization of the system. These checks complement the performance evaluations and are not intended to replace them. Maintenance checks will be performed to insure that local personnel have the training and equipment to maintain the system in an optimum condition.

6-2. TEST PROCEDURES.

a. Operations Checks. The following areas will be checked:

(1) Wideband and narrowband subscriber terminal operating procedures and information.

(2) Switch operating procedures and information.

(3) Availability of publications.

b. Maintenance Checks. The following areas will be checked.

(1) AUTOSEVOCOM Network Assessment Facility (ANAF) familiarity.

(2) Alignments performed in accordance with appropriate publications.

(3) Availability of necessary test equipment.

(4) Availability of spare boards.

(5) Availability of extender boards.

(6) Availability of equipment technical orders (TO), technical manuals (TM), Navy (NAVELEX) manuals and publications.

(7) Performance of line checks.

6-3. COMPLETION OF FORMS. Data sheets will be completed in full. Sample data sheets for recording facility general information (USACC Form 373-R (Test), figure A-23); operations checklist (USACC Form 374-R (Test), figure A-24); and maintenance checklists (USACC Form 375-R(Test), figure A-25) are shown in appendix A and may be locally reproduced.

CHAPTER 7

EQUIPMENT TECHNICAL EVALUATION

7-1. TEST PROCEDURES. This chapter includes tests to evaluate equipment associated with the AUTOSEVOCOM system. Because many of the tests are classified, complete instructions are not included in this chapter. Appropriate technical manuals (TM) are referenced. A list of recommended test equipment and sample data sheets are included for each test.

7-2. EVALUATION OF TEST RESULTS. Parameters and specifications are included on the test forms when possible. Problem areas located during equipment testing must be explained in the appropriate section.

7-3. ORDER OF TESTS. The order of testing listed here is a suggested sequence that will assist in identifying problem areas. For a formal report, the equipment (E) tests should be placed in the following order.

TEST NO.	TITLE	FORM NO.
AT-E1	Red Telephone, TA-814/G	USACC Form 376-R (Test)
AT-E2	Secure Cord Board (SECORD)	USACC Form 377-R (Test)
AT-E3	TSEC/HY-2	USACC Form 378-R (Test)
AT-E4	TSEC/KY-3	USACC Form 379-R (Test)
AT-E5	TSEC/KG-13	USACC Form 380-R (Test)
AT-E6	Switching Control Subsystem (SCS)	USACC Form 381-R (Test)
AT-E7	Synchronizer, Electrical SN-394/G	USACC Form 382-R (Test)
AT-E8	Modem/TSEC/KG-13 Bit Error Rate	USACC Form 380-R (Test)

7-4. TYPES OF DATA TO BE COLLECTED.

a. Preliminary Data. Data gathered on a particular piece of equipment are considered preliminary data if corrective actions are necessary for the system to meet the required performance standards.

b. Final Data. Data gathered from tests performed on equipment which meets the necessary performance standards or on equipment of such condition that corrective action cannot be initiated in a timely manner are considered final data.

c. Corrective Actions. After completing preliminary tests and all possible corrective actions, final testing will be accomplished. If, for any reason, a noted performance deficiency or abnormality cannot be corrected during the period of evaluation, final data will be collected and qualified as to reason or suspected reason for poor performance as well as why the corrective action was not accomplished.

7-5. DIAGNOSTIC ANALYSIS.

a. All measured/recorded data will be reviewed in detail, and a precise comparative analysis will be conducted between these data and the specifications in the referenced TMS. The results of this comparison will be reflected in the formal written report of the evaluation.

b. In a formal evaluation, a further, more detailed diagnostic evaluation will be performed. Copies of comments from the detailed analysis will be forwarded to the appropriate agencies.

7-6. AT-E1, RED TELEPHONE, TA-814/G.

a. General. The purpose of this test is to evaluate the red telephone, TA-814/G for proper operation and correct alignment. Final data are to be recorded on a form similar to USACC Form 376-R (Test), figure A-26.

b. Test Equipment. Test set, AN/USM 181 (HP 3550), or equivalent.

c. Specifications. Specifications are given in (C) TM 11-5805-620-14 (U).

d. Test Procedures. Testing will be performed in accordance with (C) TM 11-5805-620-14 (U).

7-7. AT-E2, SECURE CORD BOARD (SECORD).

a. General. The purpose of this test is to evaluate the SECORD equipment for proper operation and correct alignment. Final data are to be recorded on USACC Form 377-R (Test), figure A-27.

b. Test Equipment. Test set, AN/USM 181 (HP 3550), or equivalent.

c. Specifications. Specifications are give in (C) TM 11-5805-620-14 (U).

d. Test Procedures. Testing will be performed in accordance with (C) TM 11-5805-620-14 (U).

7-8. AT-E3, TSEC/HY-2.

a. General. The purpose of this test is to evaluate the TSEC/HY-2 equipment for proper operation and correct alignment. Final data are to be recorded on USACC Form 378-R (Test), figure A-28.

b. Test Equipment. Oscilloscope, Tektronix Model 475, or equivalent; test set, AN/USM 181, HP 3550; voltohmmeter, Simpson 313, or equivalent; frequency counter, HP 5300A, or equivalent; resistor, 220 ohm, ¼ watt, 5 percent tolerance; extender card and test leads.

c. Specifications. Specifications are given in (C) TM 11-5805-620-14 (U).

d. Test Procedures. Testing will be performed in accordance with (C) TM 11-5805-620-14 (U).

7-9. AT-E4, TSEC/KY-3.

a. General. The purpose of this test is to evaluate the TSEC/KY-3 equipment for proper operation and correct alignment. Final data are to be recorded on forms similar to USACC Form 379-R (Test), figure A-29.

b. Test Equipment. Oscilloscope, Tektronix Model 475, or equivalent; test set, AN/USM 181 (HP 3550), or equivalent; distortion analyzer, HP 334A, or equivalent; voltohmmeter, Simpson 313, or equivalent; extender cord board puller, drawer extension cable, and test leads.

c. Specifications. Specifications are given in (C) TM 11-5805-620-14 (U).

d. Test Procedures. Testing will be performed in accordance with (C) TM 11-5805-620-14 (U).

7-10. AT-E5, TSEC/KG-13.

a. General. The purpose of this test is to evaluate the TSEC/KG-13 equipment for proper operation and correct alignment. Final data are to be recorded on USACC Form 380-R (Test), figure A-30.

b. Test Equipment. Oscilloscope, Tektronix Model 475 or equivalent.

c. Specifications. Specifications are given in (C) TM 11-5805-620-14 (U).

d. Test Procedures. Testing will be performed in accordance with (C) TM 11-5805-620-14 (U).

7-11. AT-E6, SWITCHING CONTROL SUBSYSTEM (SCS).

a. General. The purpose of this test is to evaluate the SCS equipment for proper operation and correct alignment. Final data are to be recorded on USACC Form 381-R (Test), figure A-31.

b. Test Equipment. Oscilloscope, Tektronix Model 475, or equivalent; digital voltmeter, HP 405CR, or equivalent; frequency counter, HP 5321B, or equivalent; two each test sets, AN/USM 181 (HP 3550), or equivalent; 600 ohm, ¼ watt resistor; extender boards and test leads.

c. Specifications. Specifications are given in (C) TM 11-5805-620-14 (U).

d. Test Procedures. Testing will be performed in accordance with (C) TM 11-5805-620-14 (U).

7-12. AT-E7, SYNCHRONIZER, ELECTRICAL SN-394/G.

a. General. The purpose of this test is to evaluate the Synchronizer, Electrical, SN-394/G (CAU) for proper operation. Final data are to be recorded on USACC Form 382-R (Test), figure A-32.

b. Test Equipment. Voltohmmeter, Simpson 313, or equivalent.

c. Specifications. Specifications are given in TM 11-5895-543-35.

d. Test Procedures. Testing will be performed in accordance with TM 11-5895-543-35.

7-13. AT-E8, MODEM/TSEC/KG-13 BIT ERROR RATE.

a. General. The purpose of this test is to evaluate the modem, digital data, MD-775/GCC and TSEC/KG-13 combination for bit errors. Final data are to be recorded on USACC Form 382-R (Test), figure A-30.

b. Test Equipment. Oscilloscope, Tektronix 422, or equivalent; frequency counter, HP 5321B, or equivalent.

c. Specifications. Specifications are given in (C) TM 11-5805-620-14 (U).

d. Test Procedures. Testing will be performed in accordance with (C) TM 11-5805-620-14 (U).

APPENDIX A

TEST, MAINTENANCE, AND DIAGNOSTIC EQUIPMENT (TMDE) LIST AND TEST FORMS

This appendix contains a listing of recommended test, maintenance, and diagnostic equipment (TMDE) for AUTOSEVOCOM test teams and includes test forms and data sheets.

TEST, MAINTENANCE, AND DIAGNOSTIC EQUIPMENT (TMDE)
FOR
AUTOSEVOCOM TEST TEAMS

Electronic Test Equipment	Military (JETDS) Nomenclature	PIL LIN Equivalent	Quantity
Oscilloscope	TEK 475, OS-261P/U	N33151	2
Frequency Counter	HP 5300A	09525N	2
Module	HP 5302A	60066N	2
Module[1]	HP 5310A		2
Digital Multimeter	HP 3470		
Digital Display	HP 34750A	60064B	2
Plug-in Multimeter	HP 34702A	60063N	2
Plug-in Battery Module[1]	HP 34720A		2
Probe[1]	HP 11096A		2
Cable[1]	HP 56A-16C		2
Test Card	HP 11456A		1
Test Set Distortion	HP 334A, AN/URM-184A	G26515	2
Test Set Telephone	HP 3550BH03, AN/USM-423	60191N	4
Test Set Impulse Noise	CP-1101/U, TTS-58A	F18785	2
Test Set Delay Measuring	TS-2669/GCM	M20069	2
Test Set Noise	HP 3555B, TA-885/U	03241N	2
Test Set Phase Jitter	48A3	60008N	2
Analyzer Spectrum	HP 3580A	60089N	2
Voltmeter True RMS	HP 3400A, AN/USM-224	60153N	2
Recorder X-Y	HP 7035B, RO-458(V)1/U	06713N	2
Recorder	HP 7702B, RO-460(V)1/U	60166N	1
Data Error Analyzer	HP 1645A, with 5060-8767	60007N	2
Cable[1]	HP 10233A		2
Recorder Digital[1]	HP 5055A		2
Cable[1]	HP 10533A		2
Test Set Frequency Translation	880A	60071N	1
Test Set	WECO 903B	08243N	2
Test Set	WECO 902B	08242N	2

Electronic Test Equipment (cont)	Military (JETDS) Nomenclature	PIL LIN Equivalent	Quantity
Camera Oscilloscope[1]	TEK C-30A		1
Adapter Camera[1]	HP 10363A		1
Test Set Data	AN/GCM-4	V94226	2
Monitor[2]	SNM-3		2
Transformer[2]	HP 4005A		2
Transformer[2]	600Ω to 135Ω		2
Filter Low Pass[2]	White MDL 3306		4
Plug, General Radio[2]	Type 274M		4
Earth Tester	TS-3221/U	V82084	1
Accessory Kit[1]	63579		1
Card Extender[2]	SMD 532020		2
Card Extender[2]	SMD 532022		2
Card Extender[2]	WECO 171A		2
Card Puller[2]	WECO 748A		2
Card Extender[2]	Philco Ford 398-10005-1		2
Card Extender[2]	ON002980		2
Card Extractor[2]	ON003037		2
Card Extender[2]	CE 188954		2
Card Extender[2]	CE 188957		2
Test Connector[2]	WECO ED-73285-30		5
Cable Special Test[2]	ON0043445		2
Card Extender[2]	ON0187811		2
Card Extender[2]	ON025682		2
Transformer AF[2]	5950-00-569-0183		2
Attenuator[2]	HP 350D		1
Bal/Unbal Transformer[2]	HP 11005A		2
Cord[2]	2W42A		2
Cord[2]	2P4C		2

[1]Non-PIL Equipment.

[2]Equipment is non-PIL. Purchasing is through local channels.

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TEST COVER PAGE	☐ PRELIMINARY ☐ FINAL	DATE
DATA SHEET		
FACILITY TESTED	DISTANT FACILITY	
THROUGH FACILITIES:		
TEST PERFORMED:	☐ WITH MINOR MODIFICATIONS	
☐ AS SPECIFIED IN TEST PROCEDURES	☐ WITH MAJOR MODIFICATIONS (Explain below)	
COMMENTS		
STANDARDS/SPECIFICATIONS		
TEAM LEADER CERTIFICATION		
NAME (Typed)	GRADE	SIGNATURE

USACC FORM 351-R (TEST)
1 OCT 76

Figure A-1. Test cover page.

AUTOSEVOCOM TECHNICAL EVALUATION PROGRAM

STATION	DATE

OPERATING UNIT AND MAILING ADDRESS

MAINTENANCE SUPPORT UNIT AND MAILING ADDRESS

PERSONNEL CONTACTED

NAME	GRADE	POSITION	ORGANIZATION

TECHNICAL EVALUATION PERSONNEL PERFORMING THE EVALUATION

NAME	GRADE	POSITION	ORGANIZATION

O&M PERSONNEL PARTICIPATING IN THE EVALUATION

NAME	GRADE	POSITION	ORGANIZATION

USACC FORM 352-R (TEST)
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Figure A-2. AUTOSEVOCOM TEP form for station and personnel.

CCP 702-3

1KHz TEST TONE LEVELS														PAGE OF PAGES									
DATA SHEET														DATE (day, month, and year)									
DCS LINK NO.			STATION UNDER TEST											TEST ENGR INIT		TECH INIT							
			TRANSMIT										RECEIVE										
EQUIP REF LEVEL (TLP)			TP-2 db		TP-3 db		TP-4 db		TP-5 db		TP-6 db		TP-7 db		TP-8 db		TP-9 db		TP-10 db		TP-11 db		
TEST TONE LEVEL			dbm0		dbm0		dbm0		dbm0		dbm0		dbm0		dbm0		dbm0		dbm0		dbm0		
CORRECT EQUIP LEVEL			dbm		dbm		dbm		dbm		dbm		dbm		dbm		dbm		dbm		dbm		
CHANNEL			INPUT TONE LEVEL		MEASURED TONE LEVELS																		
SG	GP	CH	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	

USACC FORM 353-R (TEST)
1 OCT 76

Figure A-3. Data sheet, test tone levels.

INSERVICE CUSTOMER LEVELS

DATA SHEET

PAGE _____ OF _____ PAGES

DATE (day, month, year)

☐ PRELIMINARY DATA ☐ FINAL DATA

DCS LINK NO.	STATION UNDER TEST	DISTANT STATION	TEST ENGR. INIT.	TECH. INIT.

EQUIPMENT REFERENCE LEVER (TLP)	TRANSMIT TP-2 db	TRANSMIT TP-3 db	TRANSMIT TP-6 db	RECEIVE TP-7 db	RECEIVE TP-10 db	RECEIVE TP-11 db

CIRCUIT DATA — MEASURED SIGNAL LEVELS

SG	G	VCH	TYPE SIGNAL	CORRECT REL LEV (dbmØ)	TOLERANCE	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)	dbm	Error (db)

PILOT LEVEL SG ____ G ____	TONE	CORRECT LEVEL dbm	MEASURED LEVEL dbm	ORDER WIRE	CORRECT LEVEL	MEASURED LEVEL	

USACC FORM 354-R (TEST)
1 OCT 76

CCP 702-3

Figure A-4. Data sheet, inservice customer levels.

CCP 702-3

CHANNEL IMPEDANCE (Manual Sweep)											PAGE _____ OF _____ PAGES
DATA SHEET											DATE (day, month, year)
☐ TRANSMIT ☐ RECEIVE	STATION UNDER TEST										TEST ENGR SIGNATURE
	DCS LINK NO.			TEST POINT TP–							
SG											
GP											
CH											
FREQ	TEST SIGNAL LEVEL, dbm; AND VARIANCE db FROM 600 OHM LOADED VALUE										
(Hz)	dbm	db	dbm	db	dbm	db	dbm	db	dbm	db	
50											
100											
200											
300											
400											
500											
600											
800											
1000											
1200											
1400											
1600											
1800											
2000											
2200											
2400											
2600											
2800											
3000											
3200											
3400											
3600											

USACC FORM 355-R (TEST)
1 OCT 76

Figure A-5. Data sheet, channel impedance (manual sweep).

LONGITUDINAL BALANCE DATA SHEET			PAGE____ OF____ PAGES DATE (day, month, year)
DCS LINK NO.	☐ TRANSMIT ☐ RECEIVE	TEST POINT TP– _____	TEST ENGR SIGNATURE

	REFERENCE TEST TONE SIG. POWER, dbm	TEST SIG, POWER REL. TO REF. TEST TONE, dbmØ	ABSOLUTE POWER OF TEST SIGNAL, dbm
TRANSMIT			
RECEIVE			

FREQUENCY			600 Hz				1000 Hz				2400 Hz			
SG	GP	CH	LINE VOLTS V1	UNBAL VOLTS V2	$\frac{V1}{V2}$	LONG BAL. $20 \log \left(\frac{V1}{V2}\right)$ db	LINE VOLTS V1	UNBAL VOLTS V2	$\frac{V1}{V2}$	LONG BAL. $20 \log \left(\frac{V1}{V2}\right)$ db	LINE VOLTS V1	UNBAL VOLTS V2	$\frac{V1}{V2}$	LONG BAL. $20 \log \left(\frac{V1}{V2}\right)$ db

USACC FORM 356-R (TEST)
1 OCT 76

Figure A-6. Data sheet, longitudinal balance.

CCP 702-3

IDLE CHANNEL NOISE DATA SHEET				PAGE _____ OF _____ PAGES DATE (day, month, year)
DCS LINK No.	TERMINAL RADIO EQUIP.	TEST TIME PERIOD START Z / STOP Z	TEST ENGR INIT	TEST TECH INIT

EQUIPMENT TEST POINTS & POWER LEVELS		DISTANT TRANSMIT	LOCAL RECEIVE
	NAME OF SITE		
	TEST POINT NUMBER	TP	TP
	EQUIP. REF. LEVEL (TLP) S_T	dbm	dbm
	TEST TONE LEV $S\frac{1}{T}$	dbm0	dbm0

SG NO.	G NO.	V CH NO.	S_m MEAS'D TEST SIGNAL POWER	IDLE VOICE CHANNEL NOISE: VISUALLY-AVERAGED NOISE PWR (N) 3KHz FLAT WEIGHTING		C-MESSAGE WEIGHTING		AVERAGE $S_T N$ db $S_m - N - S\frac{1}{T}$ (dbm) (dbm) (dbm0)		MED RSL FROM STRIP CHART
			dbm	dbm	dbm	dbm	dbm0	FLAT	C-MSG	dbm

USACC FORM 357-R (TEST)
1 OCT 76

Figure A-7. Data sheet, idle channel noise.

AD-A033 660 ARMY COMMUNICATIONS COMMAND FORT HUACHUCA ARIZ F/G 17/2
AUTOSEVOCOM SYSTEM TECHNICAL EVALUATION. OPERATIONAL QUALITY AS--ETC(U)
OCT 76

UNCLASSIFIED ACC-CCP--702-3 NL

2 OF 2
ADA033660

END

DATE
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2 -77

AT–6	IMPULSE NOISE (NARROWBAND)					
RECEIVE TEST TIME			RECEIVE TEST TIME			SPECIFICATION
START (Z)	STOP (Z)	ELAPSED TIME	START (Z)	STOP (Z)	ELAPSED TIME	
COUNTER SETTING			COUNTER SETTING			
LOW dbrn	MID dbrn	HIGH dbrn	LOW dbrn	MID dbrn	HIGH dbrn	
COUNTS			COUNTS			
LOW	MID	HIGH	LOW	MID	HIGH	

AT–6	IMPULSE NOISE (WIDEBAND)					
SECORD RECEIVE TEST TIME			SUBSCRIBER RECEIVE TEST TIME			SPECIFICATION
START (Z)	STOP (Z)	ELAPSED TIME	START (Z)	STOP (Z)	ELAPSED TIME	
COUNTER SETTING			COUNTER SETTING			
LOW dbrn	MID dbrn	HIGH dbrn	LOW dbrn	MID dbrn	HIGH dbrn	
COUNTS			COUNTS			
LOW	MID	HIGH	LOW	MID	HIGH	

COMMENTS:

USACC FORM 358-R (TEST)
1 OCT 76

Figure A-8. Data sheet, impulse noise.

SINGLE CHANNEL FREQUENCY RESPONSE AND DELAY DISTORTION WORK SHEET

FREQ (Hz)	CHANNEL IMPEDANCE (Test Tone Variance dbm) Transmit	Receive	CHANNEL FREQUENCY RESPONSE (Measured Level dbm)	CHANNEL ENVELOPE DELAY DISTORTION (Measured Delay μ sec)	FREQ (Hz)	CHANNEL IMPEDANCE (Test Tone Variance dbm) Transmit	Receive	CHANNEL FREQUENCY RESPONSE (Measured Level dbm)	CHANNEL ENVELOPE DELAY Distortion (Measured Delay μ sec)
100					1900				
200					2000				
300					2100				
400					2200				
500					2300				
600					2400				
700					2500				
800					2600				
900					2700				
1000					2800				
1100					2900				
1200					3000				
1300					3100				
1400					3200				
1500					3300				
1600					3400				
1700					3500				
1800					3600				

COMMENTS:

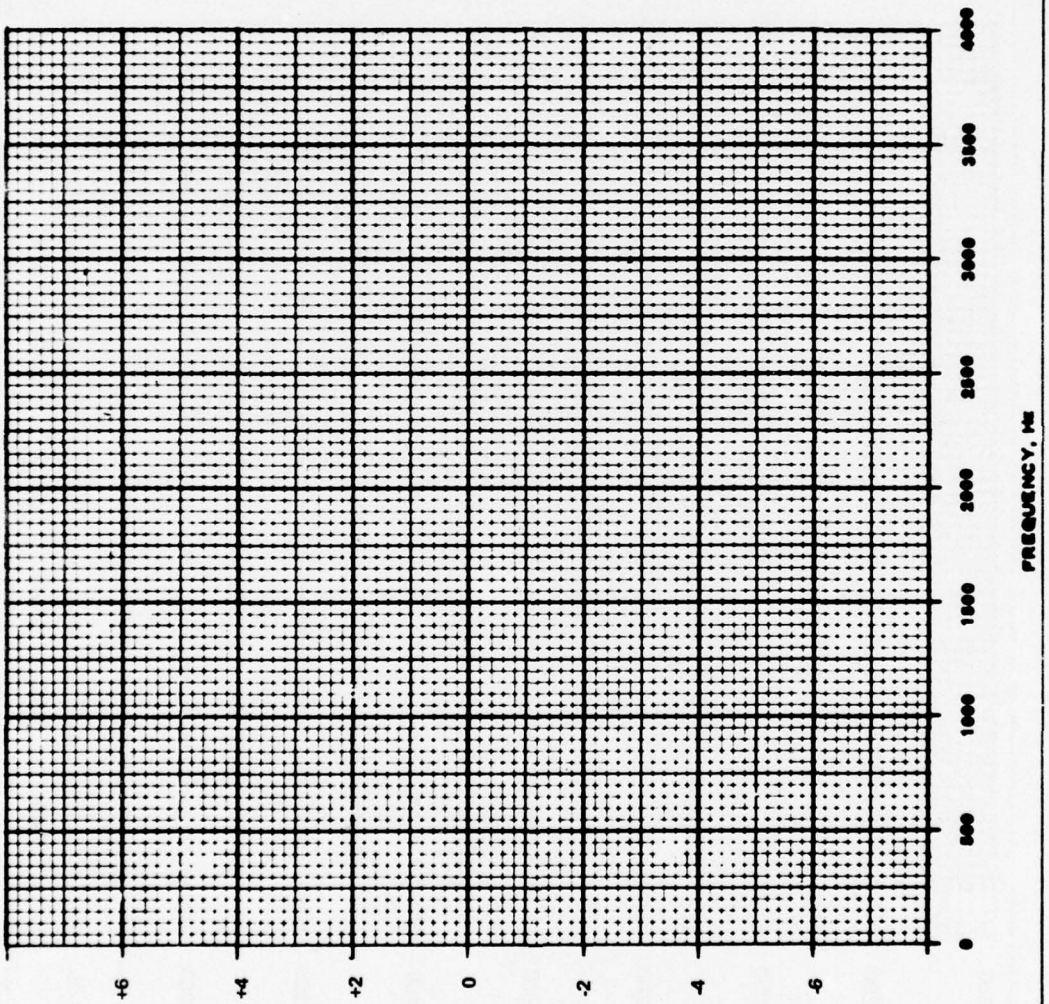
USACC FORM 359-R (TEST)
1 OCT 76

Figure A-9. Single channel frequency response and delay distortion work sheet.

FREQUENCY RESPONSE (NARROWBAND)	FACILITY TESTED	DATE
	DISTANT FACILITY	INITIALS

PRELIMINARY _____

FINAL _____



LEVEL (dbm) REFERENCED AT 1 kHz

USACC FORM 360-R (TEST)
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Figure A-10. Frequency response (narrowband).

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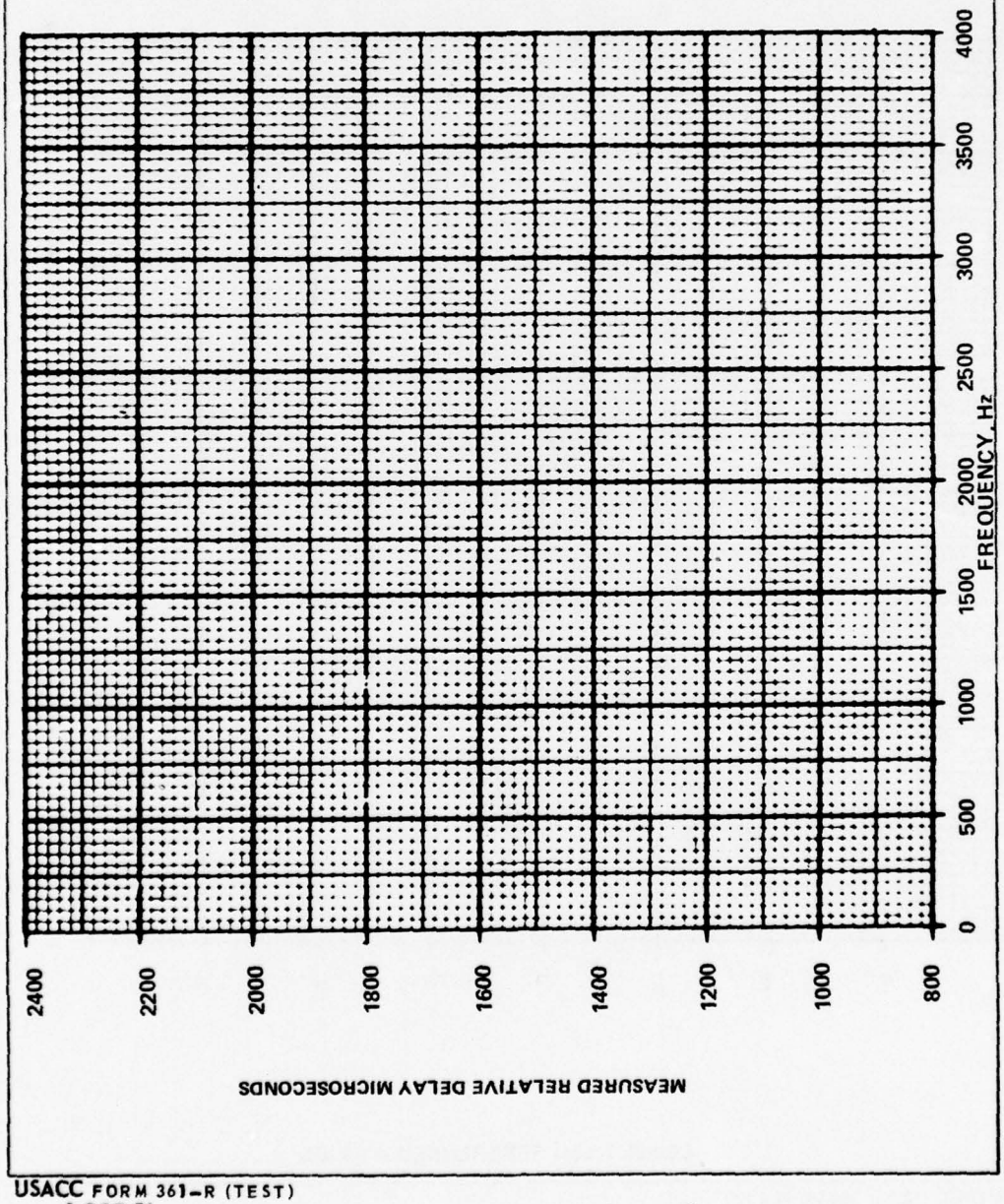
ENVELOPE DELAY DISTORTION (NARROWBAND)	FACILITY TESTED	DATE
	DISTANT FACILITY	INITIALS

PRELIMINARY _____

FINAL _____



USACC FORM 361-R (TEST)
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Figure A-11. Envelope delay distortion (narrowband).

SINGLE CHANNEL IMPEDANCE (AT-3)
FREQUENCY RESPONSE (AT-7) AND
ENVELOPE DELAY (AT-8) WIDEBAND WORKSHEET

SUBSCRIBER RECEIVE							SECORD RECEIVE						
FREQ KHz	CHANNEL IMPEDANCE		FREQUENCY RESPONSE			MEASURED ENVELOPE DELAY	FREQ KHz	CHANNEL IMPEDANCE		FREQUENCY RESPONSE			MEASURED ENVELOPE DELAY
	XMIT	REC	BARE LINE LOSS	CIRCUIT LOSS	ADJ CIRCUIT LOSS	(μsec)		XMIT	REC	BARE LINE LOSS	CIRCUIT LOSS	ADJ CIRCUIT LOSS	(μsec)
.1							.1						
.5							.5						
1.0							1.0						
3							3						
5.5							5.5						
6							6						
10							10						
18							18						
20							20						
25							25						
30							30						
32							32						
40							40						
46							46						
48							48						
49							49						
49.5							49.5						
50							50						

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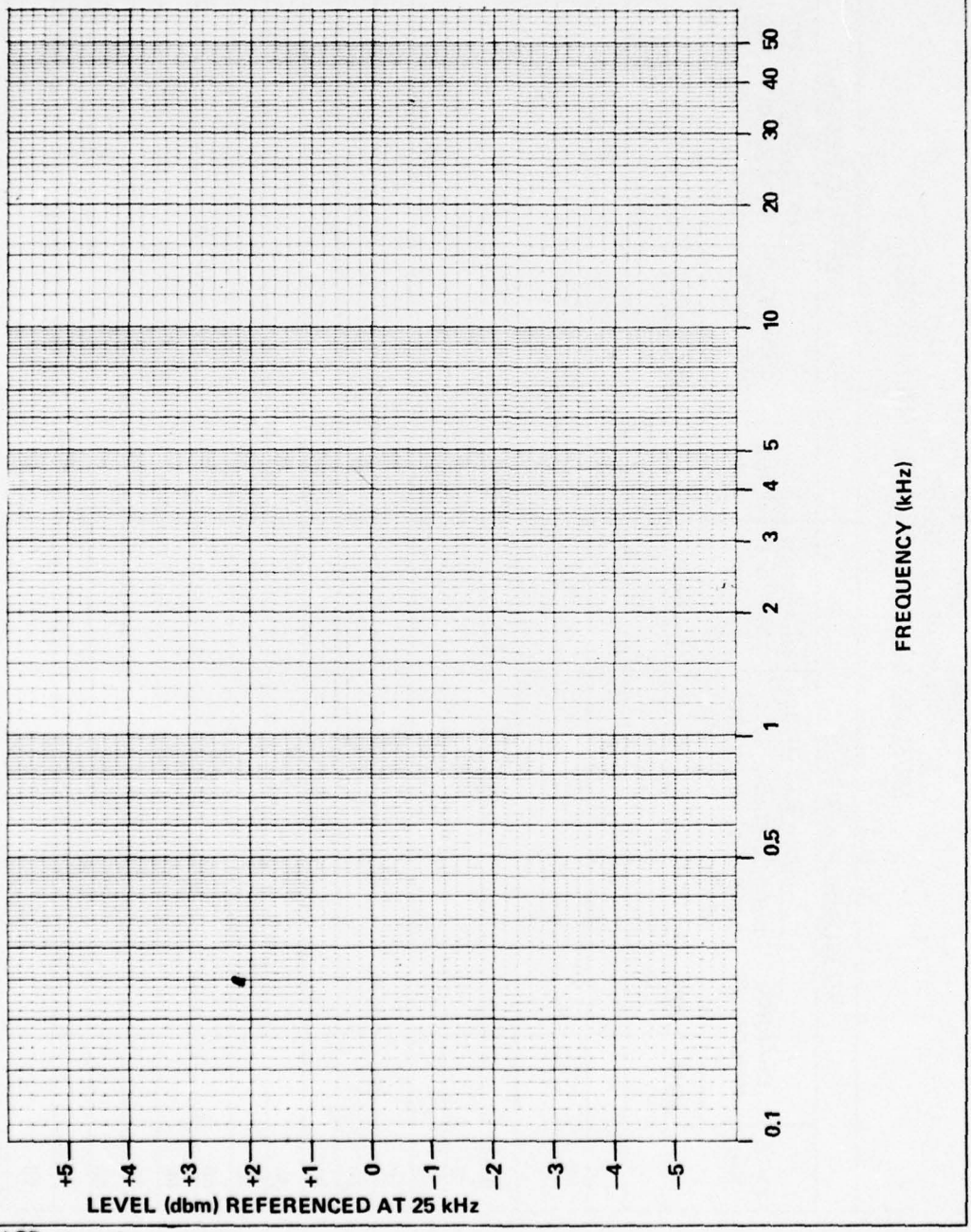
Figure A-12. Worksheet for AT-3, AT-7, and AT-8.

CCP 702-3

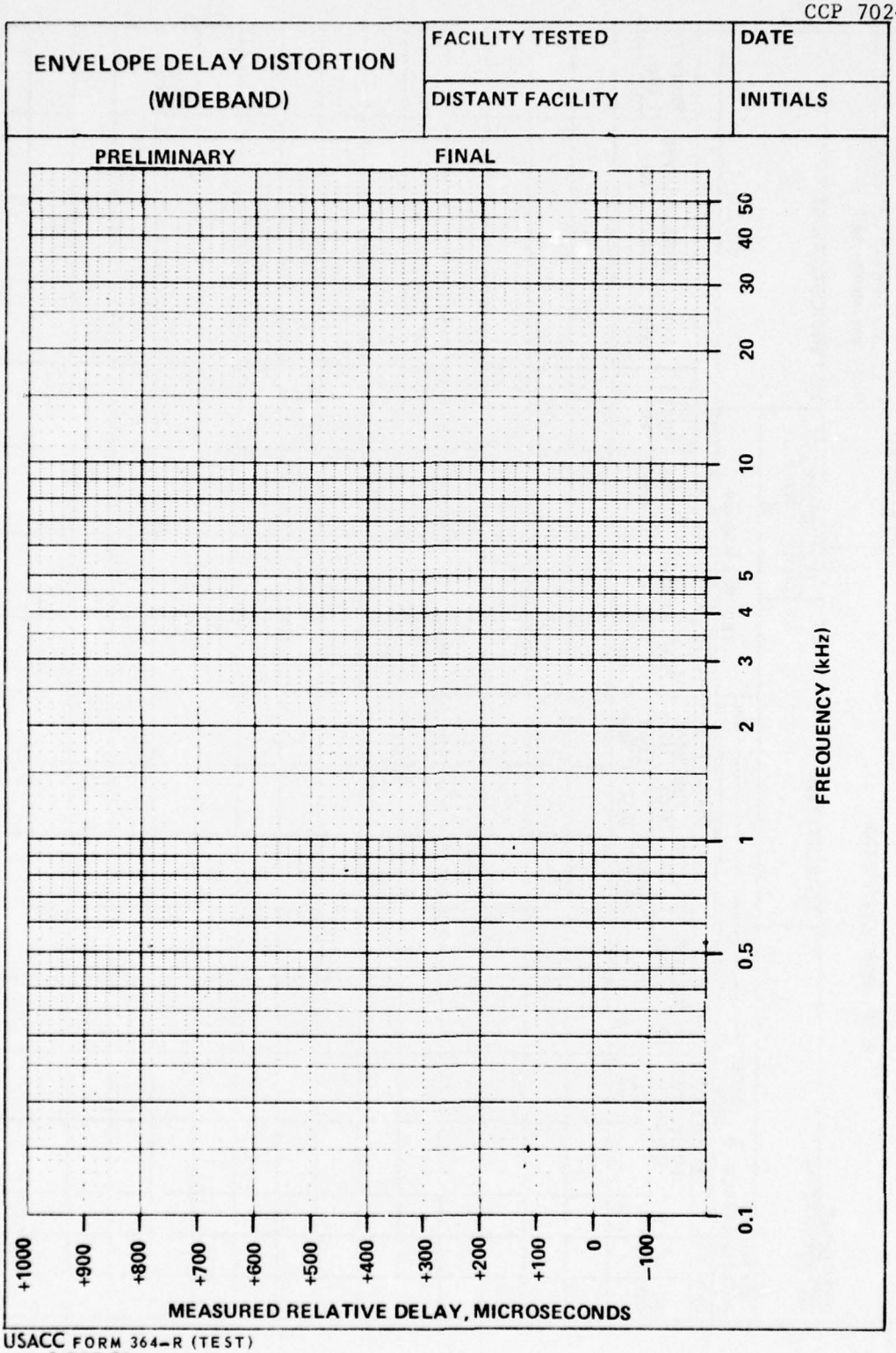
FREQUENCY RESPONSE (WIDEBAND)	FACILITY TESTED	DATE
	DISTANT FACILITY	INITIALS

PRELIMINARY _____ FINAL _____



USACC FORM 363-R (TEST)
1 OCT 76

Figure A-13. Frequency response (wideband).



USACC FORM 364-R (TEST)
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Figure A-14. Envelope delay distortion (wideband).

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HARMONIC DISTORTION

DATA SHEET

DCS LINK NO.

PAGE _____ OF _____ PAGES

DATE (day, month, year)

DISTANT STATION

LOCAL STATION

TEST TIME PERIOD — START Z — STOP Z

TEST ENGR. SIGNATURE

TEST POINTS AND TLP LEVELS ▶ TRANS: TP— _____ : _____ dbm
REC: TP— _____ : _____ dbm

TEST SIG. = 0dbm0

CHANNEL			DISTORTION ANALYZER					DISTORTION ANALYSIS (FREQ, SEL. Vm.)										
SG NO.	G NO.	V. CH. NO.	RECEIVE TEST SIG. LEVEL		MEASURED DISTORTION		RESID-UAL NOISE	FREQUENCY, Hz 1400 / 2100 / 2300 — LEVEL			FREQ. Hz	LEVEL dbm	FREQ. Hz	LEVEL dbm	FREQ. Hz	LEVEL dbm	PERCENT DIS-TORTION
			dbm	Error db	db	%	db	dbm	dbm	dbm							

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Figure A-15. Data sheet, harmonic distortion.

FREQUENCY TRANSLATION

DATA SHEET

PAGE _____ OF _____ PAGES

DCS LINK NO

TEST TIME PERIOD — START _____ Z — STOP _____ Z

DATE (day, month, year)

TEST ENGR SIGNATURE

TEST POINTS — DISTANT STATION (XMIT) — LOCAL STATION (RCV)

CHANNEL			FREQUENCY		TRANSLATION (F_{TX} MINUS F_{RX}) (Hz)
SG	GP	CH	TRANSMIT (Hz)	RECEIVE (Hz)	

USACC FORM 366-R (TEST)
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Figure A-16. Data sheet, frequency translation.

FREQUENCY TRANSLATION (OSCILLOSCOPE METHOD)

DATA SHEET
☐ OSCILLOSCOPE METHOD ☐ METER METHOD

PAGE _____ OF _____ PAGES

DATE (day, month, year)

DCS LINK NO.	TEST TIME PERIOD START Z	TEST TIME PERIOD STOP Z	TEST ENGR INIT	TECH INIT

TEST POINTS

DISTANT STATION (XMIT)	LOCAL STATION (RCV)

CHANNEL SG	CHANNEL GP	CHANNEL CH	CYCLES COUNTED	ELAPSED TIME (SECONDS)	TRANSLATION

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Figure A-17. Data sheet, frequency translation (oscilloscope method).

PHASE JITTER AND PHASE HITS
(Meter Method)

DATA SHEET

PAGE ________ OF ________ PAGES

DATE (day, month, year)

DCS LINK NO.	STATION UNDER TEST	DISTANT STATION	TEST ENGR SIGNATURE

INPUT TEST POINT NO.	OUTPUT TEST POINT NO.	CHANNEL SG NO.	G NO.	V.CH. NO.	PEAK–PEAK PHASE JITTER DLG	NUMBER OF PHASE HITS IN MINUTES

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Figure A-18. Data sheet, phase jitter (meter method).

AT–12	INTERMODULATION DISTORTION				
	RECEIVE TONE LEVELS				DISTORTION
RECEIVE	KHz dbm	KHz dbm	KHz dbm	KHz dbm	db
	KHz dbm	KHz dbm	KHz dbm	KHz dbm	%
RECEIVE	KHz dbm	KHz dbm	KHz dbm	KHz dbm	db
	KHz dbm	KHz dbm	KHz dbm	KHz dbm	%

COMMENTS:

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Figure A-19. Data sheet, intermodulation distortion.

TSEC/KY-3 EVALUATION TESTS	PERIOD OF TEST START _____ Z STOP _____ Z	DATE (day, month, year) _____ TEST ENGINEER'S SIGNATURE

SUBSCRIBER IDENTIFICATION	AUTOVON NUMBER
SUBSCRIBER LOCATION	SEQUENCE NUMBER

TSEC/KY-3 EVALUATION TESTS

SUBSCRIBER LINE

CABLE DATA:

TYPE	GAUGE	FROM SWITCH	TO	LENGTH (FT)	ROUTING

WLR-5 CONDITIONING EQUIPMENT:

LOCATION SWITCH	TYPE	REMARKS:

INSERTION LOSS AT 25 KHz AT A1	DAY	NIGHT	EXPECTED LOSS
SUBSCRIBER Tx LINE			
SUBSCRIBER Rx LINE			
DC LOOP RESISTANCE AT A2	MEASURED	CALCULATED	CABLE RECORD
SUBSCRIBER Tx LINE			
SUBSCRIBER Rx LINE			

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Figure A-20. Data sheet, TSEC/KY-3.

WIDEBAND CABLE FREQUENCY RESPONSE WITH WLR-5

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SUBSCRIBER RECEIVE						SECORD RECEIVE					
	A	B	C	D	E	F	A	B	C	D	E	F
DC LOOP OHMS												
FREQ kHz	FROM / TO	FROM / TO	FROM / TO	FROM / TO	FROM / TO		FROM / TO	FROM / TO	FROM / TO	FROM / TO	FROM / TO	
0.1						0.1						
0.5						0.5						
1.0						1.0						
3						3						
5.5						5.5						
6						6						
10						10						
18						18						
20						20						
25						25						
30						30						
32						32						
40						40						
46						46						
48						48						
49						49						
49.5						49.5						
50						50						

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Figure A-21. Data sheet, wideband cable frequency response with WLR-5.

NBST PERFORMANCE CHECKS	PERIOD OF TEST START _____ STOP _____	DATE (day, month, year) _____ TEST ENGINEER'S SIGNATURE
SUBSCRIBER IDENTIFICATION	AUTOVON NUMBER	
SUBSCRIBER LOCATION	SEQUENCE NUMBER	

PERFORMANCE CHECKS

CLEAR WARNING TONE AND VOICE LEVELS – REMARKS:

SYNCHRONIZATION CHECK	NO. OF SEQUENCES PER ATTEMPT
DESCRIPTION OF TEST: A TOTAL OF FIVE SYNCHRONIZATION ATTEMPTS ARE TO BE MADE. THE TOTAL NUMBER OF INDICATOR LAMP PULSES ARE SHOWN AT RIGHT.	1 2 3 4 5

CLEAR AND SECURE VOICE QUALITY CHECK

REMARKS: _____

PREEMPTION CHECK

REMARKS: _____

AUTHORIZED PRECEDENCE CHECK

REMARKS: _____

SYNC VERIFICATION AND ALARM CHECK

REMARKS: _____

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Figure A-22. NBST performance checks.

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AUTOSEVOCOM FACILITY GENERAL INFORMATION					Page of pages
FACILITY NAME			DATE (day,month,year)		TEST ENGR INITIALS
LOCATION			BLDG NUMBER		TYPE OF FACILITY
NUMBER OF TRUNKS			NUMBER OF SUBSCRIBERS		
HY-2	HY-11	WIDEBAND	WIDEBAND	NARROWBAND	
AUTOVON SWITCH FACILITY					TEL NO.
COMMERCIAL TEL COMPANY/REP		TEL NO.	COMMANDING OFFICER		TEL NO.
O&M UNIT/COMD			MAINTENANCE OFFICER		TEL NO.
OPERATIONS OFFICER		TEL NO.	AUTOSEVOCOM MAINT SUPV		TEL NO.

TRUNK INFORMATION

TK NO.	CCSD	VOCODER	AUTOVON NO.	MAX AREA	MAX PRECEDENCE
1					
2					
3					
4					
5					

REMARKS

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Figure A-23. AUTOSEVOCOM facility general information.

AUTOSEVOCOM FACILITY GENERAL INFORMATION (CONTINUED) Page of Pages					
SUBSCRIBER INFORMATION					
SUB NO.	CCSD	OFFICE SYMBOL	BLDG NO./ ROOM NO.	MAX CALLING AREA	MAX CALLING PRECEDENCE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					

Figure A-23. AUTOSEVOCOM facility general information. (Continued)

CCP 702-3

AUTOSEVOCOM FACILITY OPERATIONS CHECKLIST					
DATE	FACILITY				TEST ENGR INITIALS
WBST/NBST		YES	NO	NA	REMARKS
IS THE SUBSCRIBER NUMBER CLEARLY MARKED AND THE MAXIMUM CALLING AREA AND PRECEDENCE PROVIDED?					
IS THE AUTOSEVOCOM DIRECTORY AVAILABLE ?					
ARE CALLING PROCEDURES CORRECT AND AVAILABLE ?					
ARE TROUBLE REPORTING PROCEDURES AND PHONE NUMBERS CORRECT AND AVAILABLE AT THE SUBSCRIBER LOCATION?					
ARE PROCEDURES FOR AUTOSEVOCOM NETWORK ASSESSMENT FACILITY (ANAF) TEST CALLS AVAILABLE ?					
IS THE TERMINAL AREA CLEARED AND IDENTIFIED FOR THE ALLOWABLE SECU-RITY LEVEL OF COMMUNICATIONS ? ARE PROPER AUTHENTICATION DIRECTIONS AVAILABLE ?					
SWITCH OPERATING PROCEDURES AND INFORMATION					
IS A LISTING OF SUBSCRIBERS WITH THEIR ASSIGNED MAXIMUM CALLING AREAS AND PRECEDENCES AVAILABLE ?					
ARE THE DCA AUTOVON AND AUTOSEVO-COM DIRECTORIES AVAILABLE ?					
ARE PROCEDURES FOR HANDLING INTER-SWITCH CALLS CORRECT AND AVAILABLE?					
ARE PROCEDURES FOR HANDLING INTRA-SWITCH CALLS CORRECT AND AVAILABLE?					
ARE PROCEDURES FOR ANAF TEST CALLS AVAILABLE ?					
ARE TROUBLE REPORTING PROCEDURES AND PHONE NUMBERS CORRECT AND AVAILABLE ?					
PUBLICATIONS					
DCA CIRCULARS					
210-0-1, DCA CIRCULARS AND NOTICES					
310-55-1 (C), OPERATION, DIRECTION & STATUS REPORTING FOR THE DCS (U)					

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Figure A-24. AUTOSEVOCOM facility operations checklist.

AUTOSEVOCOM FACILITY OPERATIONS CHECKLIST (CONTINUED)

DCA CIRCULARS (CONT)	YES	NO	NA	REMARKS
310–70–57 (including supplements 3 and 4), DCS Quality Assurance Program				
310–S70–12 (C) , Automatic Secure Voice Communications (AUTOSEVOCOM) Network Operating Procedures (U)				
310–S85–6, Automatic Secure Voice Communications (SUTOSEVOCOM) Performance Report				
310–S175–10 (C), DCA Criteria for Narrowband and Wideband Subscriber Terminals, AN/FTC–31, SEVAC and Secure Cord Board (SECORD) (U)				
310–S115–2 (C), Control of AUTOSEVOCOM Cryptographic Keying Material (U)				
350–S110–1 (C), Defense Communications Worldwide Automatic Secure Voice (AUTOSEVOCOM) Program Security Procedures and Classifications Guide (U)				
350–S110–2 (C), Defense Communications Worldwide Automatice Secure Voice (AUTOSEVOCOM) Program Security Clearance Requirements for Maintenance and Operating Personnel (U)				
370–S185–9 (C), AUTOSEVOCOM Network Switching Plan (U)				
DCA AREA CIRCULARS				
310–S70–3 (C), Management, Control and Operating Procedures of the Automatic Secure Voice Communications (AUTOSEVOCOM) Network (U)				
310–65–1, Circuit Directory Responsibilities and Procedures				
310–55–1 (Appropriate Supplements) , Operational Direction and Status Reporting for the DCS				
JANAPS				
137 (B), Automatic Voice Network (AUTOVON) Operating Procedures				
138 (C), Automatic Secure Voice Communications (AUTOSEVOCOM) Network Operating Procedures (U)				
REMARKS				

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Figure A-24. AUTOSEVOCOM facility operations checklist. (Continued)

CCP 702-3

AUTOSEVOCOM FACILITY MAINTENANCE CHECKLIST	FACILITY	
	DATE (day, month, year)	TEST ENGR INIT

CHECK	YES/NO/NA/REMARKS
1. Is the Operator, Organizational Direct Support, and General Support Maintenance Manual (ASTM) for the Automatic Secure Voice Communications (AUTOSEVOCOM) System available? TM 11-5805-620-14, NAVELEX 0967-426-9010, TO 31W2-1-481	
2. Is the AUTOSEVOCOM Network Assessment Facility (ANAF) function known by the AUTOSEVOCOM maintenance supervisor?	
3. Is the ANAF function known by the AUTOSEVOCOM technician(s)?	
4. Are alignments being performed IAW the ASTM, KAM, TO, TM or NAVELEX manuals on:	
a. KY-3	
b. HY-2	
c. HY-11	
d. SCS	
e. KG-13	
f. Modem	
g. Red Telephone (TA-814/G)	
h. SECORD	
i. SEVAC	
j. AN/FTC-31	
k. SFU	
l. WLR-5	
5. Are the following test equipments available to the AUTOSEVOCOM facility?	

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Page 1 of 4 pages

Figure A-25. AUTOSEVOCOM facility maintenance checklist.

a. Transmission Measuring Set	
b. Distortion Analyzer	
c. Oscilloscope	
d. Frequency Counter	
e. Volt-Ohm Meter	
f. Noise Measuring Set	
g. Impulse Noise Measuring Set	
h. Envelope Delay Test Set	
6. Are spare component boards available for the following equipment?	
a. KY-3	
b. HY-2	
c. HY-11	
d. SCS	
e. KG-13	
f. CAU	
g. Modem	
h. SECORD	
i. SEVAC	
j. AN/FTC-31	
k. SFU	
l. WLR-5	
7. Are extender boards for the following equipment on hand?	
a. KY-3	
b. HY-2	
c. HY-11	
d. SCS	
e. KG-13	

Figure A-25. AUTOSEVOCOM facility maintenance checklist. (Continued)

f. CAU	
g. Modem	
8. Are TO, TM, or NAVELEX manuals available for the following equipments?	
a. NBST/SCS	
b. Red Telephone (TA-814/G)	
c. CAU	
d. Modem	
e. SECORD	
f. SEVAC/FTC-31	
g. WLR-5	
h. Narrowband Line Conditioning Equipment	
9. Are Wideband lines periodically tested IAW the ASIN?	
10. Are recorded test results on hand?	
11. Are narrowband lines periodically tested IAW DCAC 310-70-1?	
12. Are the following publications on site?	
a. AFM 400.36/DAP 750-15/NAVPAM 4110.1, Logistic Support Plan for Automatic Secure Voice Communications Network (AUTOSEVOCOM).	
b. DCAC 300-175-9, DCS Operating - Maintenance Electrical Performance Standards.	
c. KAO-77 ( )/TSEC	

13. Personnel	Number Authorized	Number Assigned
REMARKS:		

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Figure A-25. AUTOSEVOCOM facility maintenance checklist. (Continued)

EQUIPMENT	NUMBER OF PERSONNEL TRAINED
a. KY-3	
b. HY-2	
c. HY-11	
d. KG-13	
e. CAU	
f. Modem	
g. SECORD	
h. FTC-31	
i. NBST	
j. Wideband Line Conditioning	
k. Narrowband Line Conditioning	
REMARKS:	

Figure A-25. AUTOSEVOCOM facility maintenance checklist. (Continued)

RED TELEPHONE (TA–814/G) EVALUATION				
DATE	FACILITY	CCSD/AUTOVON NO.	TEST ENGR INIT	TECH INIT

1. ANAF EVALUATION	INITIAL RATING	FINAL RATING

2. PERFORMANCE DATA

TEST	REMARKS	
	INITIAL	FINAL
PLAIN INDICATION (No lights-dial tone)		
WARNING TONE		
SYNC INDICATION		
SECURE INDICATION		
RESYNC INITIATE		
SYNC ALARM		
MAXIMUM CALLING AREA		
MAXIMUM PRECEDENCE		
PREEMPT DETECT PLAIN/SECURE		

3. ALIGNMENT DATA

TEST/ADJ	ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
AMPLIFIER GAIN	-15.0dbm		dbm	
DTMF LEVEL	-3 to -11dbmØ		dbmØ	
AURAL ALARM	As required			

REMARKS

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Figure A-26. Data sheet, red telephone (TA-814/G) evaluation.

DATA SHEET SECORD EVALUATION										
DATE (Day, month, year)		FACILITY				TEST ENGR INITIALS		TECH INITIALS		
SECORD SERIAL NO.	NUMBER OF TRUNKS					NUMBER OF SUBSCRIBERS				
	HY-2		HY-11		WIDEBAND	WIDEBAND		NARROWBAND		
TEST	TRUNK 1 CCSD:		TRUNK 2 CCSD:		TRUNK 3 CCSD:		TRUNK 4 CCSD:		TRUNK 5 CCSD:	
	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
KY-3 ALARM										
CALL/ANSWER INDICATOR										
SYNC INDICATION										
SECURE INDICATION										
RESYNC										
SYNC ALARM										
MAXIMUM CALLING AREA										
MAXIMUM CALLING PRECEDENCE										
PREEMPT INITIATE PLAIN/SECURE										
PREEMPT DETECT PLAIN/SECURE										

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CCP 702-3

Figure A-27. Data sheet, SECORD evaluation.

DATA SHEET SECORD EVALUATION (CONTINUED)						
3 (CONT)						
SUB NO.	C/A LIGHT AND ALARM		2600 Hz LEVEL (dbm)		CIPHER LEVEL (dbm)	
	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
1			dbm	dbm	dbm	dbm
2			dbm	dbm	dbm	dbm
3			dbm	dbm	dbm	dbm
4			dbm	dbm	dbm	dbm
5			dbm	dbm	dbm	dbm
6			dbm	dbm	dbm	dbm
7			dbm	dbm	dbm	dbm
8			dbm	dbm	dbm	dbm
9			dbm	dbm	dbm	dbm
10			dbm	dbm	dbm	dbm
11			dbm	dbm	dbm	dbm
12			dbm	dbm	dbm	dbm
13			dbm	dbm	dbm	dbm
14			dbm	dbm	dbm	dbm
15			dbm	dbm	dbm	dbm
16			dbm	dbm	dbm	dbm
17			dbm	dbm	dbm	dbm

Figure A-27. Data sheet, SECORD evaluation. (Continued)

DATA SHEET SECORD EVALUATION (CONTINUED)				
3 (Cont)				
TEST/ADJ	ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
DTMF LEVEL	–9.0 dbm		dbm	dbm
SUBSCRIBER RING FREQUENCY	1000±15 Hz		Hz	Hz
SUBSCRIBER RING LEVEL	–5.0 dbm		dbm	dbm
TELEPHONE TRANSMIT LEVEL	0.0 dbm		dbm	dbm
SUBSCRIBER BOARD STRAPPING	AS REQUIRED			
SUBSCRIBER 2600 Hz SENSITIVITY	FULL CCW			
AUDIBLE ALARM	AS REQUIRED			
EIM–7	INSTALLED			
REMARKS				

Figure A-27. Data sheet, SECORD evaluation. (Continued)

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TSEC/HY-2 EVALUATION			
DATE	FACILITY	CONFIGURED AS ☐ NBTU ☐ NBST	SERIAL NUMBER
TRUNK/CCSD/NBST NUMBER		TEST ENGR INITIALS	TECH INITIALS
ANAF EVALUATION		INITIAL RATING	FINAL RATING

ALIGNMENT DATA					
TEST/ADJ		ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
POWER SUPPLY VOLTAGE	+12	+12.00 VDC		VDC	VDC
	-12	-12.00 VDC		VDC	VDC
	- 6	-6.00 VDC		VDC	VDC
	+ 6	+6.00 VDC		VDC	VDC
POWER SUPPLY RIPPLE	+12	3 mVp-p		mVp-p	mVp-p
	-12	3 mVp-p		mVp-p	mVp-p
	- 6	10 mVp-p		mVp-p	mVp-p
	+ 6	5 mVp-p		mVp-p	mVp-p
INTERNAL OSCILLATOR	FREQUENCY	76.8 $\pm$0.2 KHz		KHz	KHz
	AMPLITUDE	4.0 $\pm$0.5 Vp-p		Vp-p	Vp-p
VOGAD	CLIPPING	> 17 Vp-p		Vp-p	Vp-p
	VOICING AND TRACKING	AS SPECIFIED			
	GAIN	0.0 $\pm$.5 dbm		dbm	dbm
	SIGNAL-TO-NOISE	> 50 db		db	db
PITCH CODING	78Hz (000001)	77 Hz		Hz	Hz
	78Hz (000010)	78 Hz		Hz	Hz
	300Hz (111111)	300 Hz		Hz	Hz
SPECTRUM CODING	1st LEVEL	.020 Vrms		Vrms	Vrms
	7th LEVEL	.200 Vrms		Vrms	Vrms
	CHAN CODING	AS SPECIFIED			
SPECTRUM SYNTHESIZERS	LEVEL	AS SPECIFIED			
	NOISE	< -52 dbm		dbm	dbm
BUZZ-HISS	60 Hz	74 Hz		Hz	Hz
	600 Hz	300 Hz		Hz	Hz
OUTPUT AMPLIFIER	LEVEL	+1.0 dbm		dbm	dbm
	PIN 28 OUTPUT	-16.0 $\pm$.5 dbm		dbm	dbm
	MAX UNDISTORT VOLTAGE	> 16 Vp-p		Vp-p	Vp-p
	NOISE LEVEL	< -40 dbm		dbm	dbm
9 db PAD (NBTU only)		INSTALLED			
MOD 11		ACCOMPLISHED			

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Figure A-28. Data sheet, TSEC/HY-2.

TSEC KY-3 EVALUATION			
DATE	FACILITY	CONFIGURED AS ☐ NBTU ☐ SUB ☐ KEY CHANGER	SERIAL NUMBER
TRUNK/CCSD/SUBSCRIBER	SUBSCRIBER	TEST ENGR INIT	TECH INIT

	INITIAL RATING	FINAL RATING
1. ANAF EVALUATION		

2. OPERATIONS CHECK	YES	NO	NA	REMARKS
Is elapsed time meter operating?				
Is elapsed time meter check being performed IAW KAO-77 ( )?				
Are customer operating procedures posted?				
Are ANAF and trouble reporting procedures posted?				
Is current AUTOSEVOCOM directory available?				

3. PERFORMANCE DATA				
TEST/ADJ	ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
VOGAD SWITCH	"IN" FOR SUB "OUT" FOR TRUNK			
SIDESTONE SWITCH	"IN" FOR SUB "OUT" FOR TRUNK			
STRAPPING OPTIONS	AS SPECIFIED			
RECEIVE AUDIO OUTPUT LEVEL	+1 dbm SUB +10 dbm Trunk		dbm	dbm
MAXIMUM AUDIO GAIN	+13 dbm Min		dbm	dbm
NOISE	$\leq$43 dbm		dbm	dbm

REMARKS

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Figure A-29. Data sheet, TSEC/KY-3.

TSEC/KY-3 EVALUATION (CONTINUED)				
PERFORMANCE DATA (CONT)				
TEST/ADJ	ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
FREQUENCY RESPONSE				
70 Hz	-10.0 ± 3.0 dbm		dbm	dbm
100 Hz	-10.0 ±3.0 dbm		dbm	dbm
300 Hz	-10.0 ±3.0 dbm		dbm	dbm
500 Hz	-10.0 ±3.0 dbm		dbm	dbm
700 Hz	-10.0 ±3.0 dbm		dbm	dbm
900 Hz (Reference)	-10.0 dbm		dbm	dbm
1100 Hz	-10.0 ± 3.0 dbm		dbm	dbm
1500 Hz	-10.0 ±3.0 dbm		dbm	dbm
1900 Hz	-10.0 ±3.0 dbm		dbm	dbm
2300 Hz	-10.0 ± 3.0 dbm		dbm	dbm
2700 Hz	-10.0 ± 3.0 dbm		dbm	dbm
3100 Hz	$-10.0\ ^{+3.0}_{-4.5}$ dbm		dbm	dbm
3500 Hz	$-10.0\ ^{+3.0}_{-4.5}$ dbm		dbm	dbm
4200 Hz	≤ -40.0 dbm		dbm	dbm
FREQUENCY DISTORTION				
70 Hz	≤ 7%		%	%
1000 Hz	≤ 3%		%	%
3000 Hz	≤ 7%		%	%
REMARKS				

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Figure A-29. Data sheet, TSEC/KY-3. (Continued)

TSEC/KY-3 EVALUATION (CONTINUED)					
4. ALIGNMENT DATA				SUBSCRIBER NUMBER	
TEST/ADJ		ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
RECEIVE THRESHOLD POTENTIOMETER		FULLY CW			
POWER SUPPLY VOLTAGE	-24	-24.0 VDC		VDC	VDC
	-12	-12.0 VDC		VDC	VDC
	-6	-6.0 VDC		VDC	VDC
	+12	+12.0 VDC		VDC	VDC
	+6	+6.0 VDC		VDC	VDC
POWER SUPPLY RIPPLE	-24	≤ 0.0030 Vrms		Vrms	Vrms
	-12	≤ 0.0070 Vrms		Vrms	Vrms
	-6	≤ 0.0050 Vrms		Vrms	Vrms
	+12	≤ 0.0025 Vrms		Vrms	Vrms
	+6	≤ 0.0025 Vrms		Vrms	Vrms
TELEPHONE PREAMPLIFIER	EXTENSION 1	1.2 Vrms		Vrms	Vrms
	EXTENSION 2	1.2 Vrms		Vrms	Vrms
VOGAD	SQUELCH CONTROL	-16.0 dbm		dbm	dbm
	AMPLITUDE STATIC RESPONSE	LOW LEVEL -4.0 to 0 dbm		dbm	dbm
		HIGH LEVEL + 3.0 from above			
NOISE AMPLITUDE		2.0 Vp-p		Vp-p	Vp-p
COMPRESSOR BALANCE		≤ 4.0%		%	%
CODE SAMPLER SLOPE		WAVEFORM			
COMPRESSOR	CENTERING	WAVEFORM			
	GAIN	WAVEFORM			
	32 WEIGHT	WAVEFORM			
DECODER 32 WEIGHT		WAVEFORM			
RECEIVE DIPHASE DETECTOR		WAVEFORM 15.0 Vp-p Min		Vp-p	Vp-p
REMARKS					

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Figure A-23. Data sheet, TSEC/KY-3. (Continued) Page 3 of 4 pages

TSEC/KY-3 EVALUATION (CONTINUED)

4. ALIGNMENT DATA (CONT)

TEST/ADJ		ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
SIDESTONE LEVEL		+10.0 dbm		dbm	dbm
AFC	DC LEVEL	+1.5 VDC		VDC	VDC
	LEADING EDGE	WAVEFORM			
2600 Hz LEVEL		-21.0 ± 1.0 dbm		dbm	dbm
TRANSMIT LINE EQUALIZER LEVEL		0 ± 2.0 dbm (SEVAC OPERATOR) +15 ± 2.0 dbm		dbm	dbm
RECEIVE LINE EQUALIZER		WAVEFORM			

REMARKS

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Figure A-29. Data sheet, TSEC/KY-3. (Continued) Page 4 of 4 pages

MODEM/KG-13 EVALUATION			
DATE	FACILITY	CONFIGURED AS ☐ NBST ☐ NBTU ☐ REGENERATOR	MODEM TYPE ☐ WECO 207 ☐ MD-823 ☐ DS 9601
TRUNK/CCSD/NBST NUMBER		TEST ENGR INITIALS	TECH INITIALS

MODEM EVALUATION	
1. VISUAL CHECKS	REMARKS
SWITCH POSITIONS	
STRAPPING POSITIONS	
RECEIVE CLOCK CORRECTION	

2. ALIGNMENT DATA

TEST/ADJ	ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
TRANSMIT LEVEL	dbm	dbm	dbm	dbm
CLOCK PERIOD	μsec	μsec	☐ IN SPEC ☐ OUT OF SPEC	☐ IN SPEC ☐ OUT OF SPEC
1ST MEASUREMENT				
2				
3				
4				
5				
6				
7				
8				
9				
10				

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Figure A-30. Data sheet, Modem/KG-13.

MODEM/KG-13 EVALUATION (CONTINUED)					
KG-13 ALIGNMENT DATA					
TEST/ADJ		ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
TRANSMIT TIMING		MIDPOINT TRANSITION			
RECEIVE TIMING		MIDPOINT TRANSITION			
TRANSMIT DC POWER SUPPLY	PIN 19	−18 VDC		VDC	VDC
	PIN 14	+ 5 VDC		VDC	VDC
	PIN 5	−18 VDC		VDC	VDC
	PIN 16	−7.5 VDC		VDC	VDC
TRANSMIT DC POWER SUPPLY RIPPLE	PIN 19	< .6Vp-p		Vp-p	Vp-p
	PIN 14	< .06Vp-p		Vp-p	Vp-p
	PIN 15	< .6Vp-p		Vp-p	Vp-p
	PIN 16	< .21Vp-p		Vp-p	Vp-p
RECEIVER DC POWER SUPPLY	TP 2	−18 VDC		VDC	VDC
	TP 3	+5 VDC		VDC	VDC
	TP 4	−7.5 VDC		VDC	VDC
	TP 5	−18 VDC		VDC	VDC
RECEIVER DC POWER SUPPLY RIPPLE	TP 2	< .55Vp-p		Vp-p	Vp-p
	TP 3	< .17Vp-p		Vp-p	Vp-p
	TP 4	< .2Vp-p		Vp-p	Vp-p
	TP 5	< .55Vp-p		Vp-p	Vp-p
REMARKS					

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Figure A-30. Data sheet, Modem/KG-13. (Continued)

SWITCHING CONTROL SUBSYSTEM (SCS) EVALUATION						
DATE	FACILITY			CONFIGURED AS ☐ NBST ☐ SECORD ☐ SEVAC		
TRUNK/CCSD/NBST NUMBER			TEST ENGR INITIALS		TECH INITIALS	
ALIGNMENT DATA						
TEST/ADJ			ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
POWER SUPPLY	BLACK	-12	-12.0±0.1 VDC		VDC	VDC
		+6	+6.0±0.1 VDC		VDC	VDC
	RED	-12	-12.0±0.1 VDC		VDC	VDC
		+6	+6.0±0.1 VDC		VDC	VDC
CONTROL LINE ADAPTER (CLA)			STRAPPING			
TONE GENERATOR	440 Hz OSCILLATOR	FREQUENCY	440±0.5 Hz		Hz	Hz
		WAVEFORM	AS SPECIFIED			
	620 Hz OSCILLATOR	FREQUENCY	620±0.5 Hz		Hz	Hz
		WAVEFORM	AS SPECIFIED			
WARNING TONE GENERATOR			STRAPPING			
COMPOSITE TONE LEVEL	R11 ADJUSTMENT		-20 dbm (SECORD)		dbm	dbm
			-17 dbm (SEVAC)		dbm	dbm
	R23 ADJUSTMENT		-17 dbm (SECORD)		dbm	dbm
			-14 dbm (SEVAC)		dbm	dbm
LINE TRANSFER UNIT (LTU)			STRAPPING			
REMARKS						

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Figure A-31. Data sheet, switching control subsystem.

SWITCHING CONTROL SUBSYSTEM (SCS) EVALUATION (CONTINUED)

ALIGNMENT DATA (CONT)

TEST/ADJ			ADJUST TO	ADJUSTED	INITIAL DATA	FINAL DATA
PREEMPT DETECTOR	440 Hz FILTER	VOLTAGE	2.0 Vrms		Vrms	Vrms
		FREQUENCY	415±1.0 Hz		Hz	Hz
	620 Hz FILTER	VOLTAGE	2.0 Vrms		Vrms	Vrms
		FREQUENCY	600±1.0 Hz		Hz	Hz
	180 Hz FILTER	VOLTAGE	2.1 Vrms		Vrms	Vrms
		FREQUENCY	620±0.5 Hz		Hz	Hz
		VOLTAGE	1.4 Vrms		Vrms	Vrms
		FREQUENCY	612±1.0 Hz		Hz	Hz
	180 Hz FREQUENCY DETECTOR		AS SPECIFIED			

TEST/ADJ	REMARKS
PREEMPT AMPLITUDE LIMITS	
SPEECH DETECTOR ADJUSTMENTS	
4 db DISCRIMINATOR CHECK	
PREEMPT OUTPUT CHECK	

REMARKS

Figure A-31. Data sheet, switching control subsystem. (Continued)

SYNCHRONIZER SN 394/G TESTS	PERIOD OF TEST START _____ Z STOP _____ Z	DATE (day month year) _____ TEST ENGINEER'S SIGNATURE
SUBSCRIBER IDENTIFICATION		AUTOVON NUMBER
SUBSCRIBER LOCATION		SEQUENCE NUMBER

POWER SUPPLY CHECKS

	MEASURED	REMARKS
+11.0 VOLTS DC		
-11.0 VOLTS DC		
+6.0 VOLTS DC		
6.0 VOLTS DC		

SYSTEM CHECKS

	REMARKS	CORRECT	
1.			SYNCHRONIZES IN MANUAL MODE.
2.			PERFORMS AN ALARM CHECK CYCLE FOLLOWED BY A SYNC CYCLE, THEN RETURNS TO NORMAL OPERATE.
3.			ORIGINATE AN ALARM CHECK CYCLE FOLLOWED BY A SYNC CYCLE, THEN RETURN TO NORMAL OPERATION.
4.			PULLS AN ALARM CHECK CYCLE UPON RECEIVING A SYNC REQUEST FROM DISTANT END.
5.			ORIGINATES AN ALARM CHECK CYCLE FOLLOWED BY A SYNC CYCLE, THEN RETURNS TO NORMAL.
6.			ORIGINATES AN ALARM CHECK CYCLE. MAKES THREE CONSECUTIVE ATTEMPS TO COMPLETE THE CYCLE, THEN ENTERS THE MASTER ALARM CONDITION.
7.			ORIGINATES SYNC ATTEMPT THREE TIMES, FAILS TRANS OPERATE, THEN ENTERS MASTER ALARM CONDITION.
8.			COMPLETES ALARM CHECK, THREE SYNC CYCLES, ENTERS MASTER ALARM CONDITION.
9.			ALARM CHECK, SYNC CYCLE, COMPLETE.
10.			PULLS THREE OP FAILURES, THEN ENTERS MASTER ALARM CONDITION.

COMMENTS: _____

_____

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Figure A-32. Data sheet, synchronizer, electrical SN-394/G.

STATION GROUND DATA SHEET		PAGE OF PAGES TEST DATE
DCS LINK	STATION UNDER TEST	TEST ENGR.

1.0 STATION GROUND

1.1 RE = Ω	1.2 DISTANCE E–C2	1.3 DISTANCE E–P2

1.4 GENERAL DESCRIPTION OF STATION GROUND

1.5 STATION GROUND CONDUCTOR	1.6 CHEMICAL TREATMENT

2.0 INTERIOR GROUND DISTRIBUTION

2.1 GENERAL DESCRIPTION OF INTERIOR GROUND DISTRIBUTION

2.2 INTERIOR GROUND FEEDER CONDUCTOR	2.3 RACK GROUND FEEDER CONDUCTOR

3.0 EXTERIOR GROUND DISTRIBUTION

3.1 GENERAL DESCRIPTION OF EXTERIOR GROUND DISTRIBUTION

3.2 EXTERIOR GROUND FEEDER CONDUCTOR	3.3 EXTERIOR GROUND DISTRIBUTION CONDUCTOR

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Figure A-33. Data sheet, station ground.

APPENDIX B

AUTOSEVOCOM TECHNICAL EVALUATION TEAM (ATET) REPORT FORMAT

B-1. PURPOSE. This appendix contains a sample report, describes the content, organization, and format; and provides guidance for its preparation.

B-2. DESCRIPTION. An ATET report will be written for each facility evaluated. The report will have the following parts.

a. Part I, Evaluation Summary. The evaluation summary will include general information about the facility, the evaluation process, the ATET members, and a narrative summary of the evaluation findings. This narrative is a concise summary of the station problems.

b. Part II, Facility Data. Part II will contain a narrative summary of the results of each test performed.

c. Part III, Attachments. Attachments will be included only when they significantly clarify the report.

B-3. FORMAT. The paragraph titles and column headings shown in the sample ATET report will not be changed. The report will consist of a cover page, letter of transmittal/distribution, and a table of contents. Follow the example for the cover page exactly.

B-4. PART I, EVALUATION SUMMARY. (The numbers in parentheses correspond to the paragraph numbers in the station report.)

a. (1.0) INTRODUCTION.

b. (1.1) GENERAL. This paragraph will contain a concise description of the AUTOSEVOCOM evaluation, the origin of the evaluating ATET, the military department/O&M agency(s) responsible for the operation and maintenance of the facility, and the dates of the evaluation.

c. (1.2) FACILITY DESCRIPTION. Give a concise description of the facility to include the type switch, number of wideband/narrowband trunks/subscribers, and the serving AUTOVON switch(s).

d. (1.3) TEAM COMPOSITION. List the name, rank/rating, and title of each team member. The title will reflect the function of the team member; i.e., team leader, team engineer, cryptographic technician.

e. (1.4) KEY PERSONNEL CONTACTED. In this section, list the key personnel who attended the inbriefing and outbriefing. Include the name, rank/service, position, and the organization/office of each individual.

f. (1.5) REFERENCES. List the references used by the ATET for each equipment item/line evaluated. When references have triservice identifiers, the identifier appropriate to the military department affiliation of the O&M evaluated will be used.

g. (2.0) GENERAL EVALUATION SUMMARY.

h. (2.1) OVERALL FINDINGS. This paragraph will consist of an introductory paragraph followed by a tabular presentation of the evaluation results. Identify the equipment item/line, the number evaluated, the number found "out-of-specs", and the number left "out-of-specs" at the conclusion of the evaluation. A unit is defined as out-of-specs if significant adjustments or corrective actions are/were required to meet the appropriate equipment/line specifications. List equipment items evaluated in the same order as the data arrangement described for part II of the report.

i. (2.2) EXCEPTIONS. If any equipment items/lines were not evaluated, state the reasons for the exception(s). If all equipment items/lines were evaluated, so state.

j. (2.3) CONCLUSIONS. This portion of the station report will be a concise overview, to include an objective discussion, of the significant evaluation findings. Subjective statements concerning the overall condition of the facility will not be made; however, an objective assessment of the capability of the facility to process secure voice traffic which is supported by the evaluation data may be included.

k. (3.0) MAINTENANCE EVALUATION SUMMARY. The maintenance evaluation summary will consist of an introductory paragraph followed by two subparagraphs, deficiencies corrected and deficiencies requiring corrective action.

l. (3.1) DEFICIENCIES CORRECTED. Paragraphs 3.1.1 through 3.1.X will identify deficiencies that were identified and corrected during the evaluation. Deficiencies common to a single equipment item/line or group of similar equipment items/lines can be combined into one paragraph. It is desirable that the order of these paragraphs follow the equipment list of paragraph 2.1. Arrange deficiencies concerning equipment items of the same type in ascending order of trunk or subscriber number to conform to the data arrangement in part II. System deficiencies which involve multiple equipment types or interfacing of AUTOSEVOCOM equipment items and the AUTOVON should follow the single equipment deficiencies listings. Deficiencies should include test

equipment, training, publications, and maintenance procedures used by the local maintenance agency. The deficiencies will be listed by paragraph number followed by a concise description of the deficiency. Immediately following the deficiency description, a second paragraph will contain a concise discussion of the deficiency and the action taken to correct it.

m. (3.2) DEFICIENCIES REQUIRING CORRECTIVE ACTION. Paragraphs 3.2.1 through 3.2.X will list deficiencies identified but not corrected during the evaluation. The format and sequence will follow paragraphs 3.1.1 through 3.1.X; however, immediately following the discussion paragraph will be a paragraph titled recommendation. This paragraph will include a recommended corrective action for the deficiency.

NOTE: If there are no findings in either paragraph 3.1 or 3.2, include the title and state that "no deficiencies were found" or "all deficiencies were corrected during the evaluation."

n. (4.0) OPERATIONS EVALUATION SUMMARY. The operations evaluation summary will consist of an introductory paragraph followed by two subparagraphs (4.1 and 4.2).

o. (4.1) DEFICIENCIES CORRECTED. Paragraphs 4.1.1 through 4.1.X will concern operational deficiencies identified and corrected during the evaluation. Deficiencies will be limited to areas which directly affect AUTOSEVOCOM performance as shown on the facility operations checklist, **figure** A-29, USACC Form 375-R. The format will follow paragraphs 3.1.1 through 3.1.X of the report.

p. (4.2) DEFICIENCIES REQUIRING CORRECTIVE ACTION. Paragraphs 4.2.1 through 4.2.X will concern operational deficiencies identified but not corrected during the evaluation. Deficiencies will be limited to those described for paragraphs 4.1.1 through 4.1.X. The format will follow paragraphs 3.2.1 through 3.2.X.

NOTE: If there are no findings in either paragraph 4.1 or 4.2, include the title and state that "no deficiencies were found" or "all deficiencies were corrected during the evaluation."

q. (5.0) TITLE AS APPROPRIATE. This and following sections are optional and will be appropriately titled. This section will be used for special tests or unusual circumstances which do not fall under the normal evaluation process. Data for this section normally will be included in part III of the report.

r. (6.0) ACKNOWLEDGMENTS. This section is optional and will be the last section of the ATET report. Acknowledgments for local unit support or other assistance provided to the team may be included. References, by name, to maintenance/operational personnel will be made only within this section.

B-5. PART II, FACILITY DATA.

a. Facility data will immediately follow part I of the report. The data will be arranged as follows:

Facility General Information
Facility Diagram
Maintenance Checklist
Operations Checklist

(For a SECORD, 758C, 758A, or FCT-31 Configuration.)

Switch Data (i.e., SECORD, SEVAC, and FTC-31, or data on the 758A/758C, if collected)

KY-3 (trunk)
HY-2
HY-11
SCS
KG-13/MODEM
Single Frequency Unit (SFU)
Narrowband (NB) Line
KY-3 (Subscriber)
Wideband (WB) Line

(For a NBST Configuration.)

Red Telephone(s)
HY-2 or HY-11
SCS
KG-13/MODEM
SFU
NB Line.

b. The facility diagram will be sketched on plain bond paper. The diagram will contain a general layout of the facility including building numbers of the switch and WBSTs, the routing, distance, and conditioning equipment for the WB and NB lines.

c. The data for identical equipment items/lines will be grouped together and arranged in ascending order of trunk or subscriber number.

d. If a facility has more than one O&M unit, separate the data by O&M but follow the above arrangement. In most cases, one O&M unit will be responsible for the switch, the associated NBTU, and several WBST. The other O&M unit may be responsible for one or more WBST homed off the switch. The data should then be as follows:

Data as arranged above for the switch O&M.
Data on WBST for second O&M.
Data on WBST for third O&M, etc.

B-6. PART III, ATTACHMENTS.

a. Attachments will follow the last data sheet of part II. They will be appropriately marked and will be arranged in the order they are referenced in the report.

b. Attachments will be limited to additional data, figures, or other information that are not appropriate in part I or part II that will significantly increase the clarity and understanding of the report.

B-7. SAMPLE ATET REPORT. An example part I of an ATET report is shown on pages B-6 through B-14. The example describes a SECORD facility, the most common AUTOSEVOCOM switch. The example details the structure of the report and all required paragraphs, subparagraphs, and column headings.

CCP 702-3

AUTOMATIC SECURE VOICE COMMUNICATIONS

(AUTOSEVOCOM)

TECHNICAL EVALUATION TEAM REPORT

RCS: DCA (AR) 520-37

FOR

_____

(STATION/FACILITY)

_____

(O&M AGENCY)

PREPARED FOR

DEFENSE COMMUNICATIONS AGENCY

BY

_____

(AGENCY PREPARING REPORT)

_____

(DATE OF REPORT)

Sample ATET report.

DEPARTMENT OF THE AIR FORCE
Headquarters Air Force Communications Service
Richards-Gebaur Air Force Base, Missouri 64030

REPLY TO
ATTN OF: (Originating ATET)

SUBJECT: AUTOSEVOCOM Technical Evaluation Team Report for (Facility Name), (Period of Evaluation)

TO: (Whom it May Concern)

The attached report has been distributed as follows:

Agency	No. of Copies
HQ DCA, Code 520	1
HQ DCA Pacific	1
HQ DCA Europe	1
Other Distribution	X

Signature Block

Sample ATET report. (Continued)

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PART I EVALUATION SUMMARY

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1.0 Introduction

2.0 General Evaluation Summary

3.0 Maintenance Evaluation Summary

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5.0 Acknowledgments

PART II FACILITY DATA

AUTOSEVOCOM Facility General Information

Facility Diagram

Maintenance Checklist

Operations Checklist

SECORD

KY-3 (Trunk)

HY-2

HY-11

SCS

KG-13 Modem

Single Frequency Unit (SFU)

Narrowband (NB) Lines

KY-3 (Subscribers)

Wideband (WB) Lines

Sample ATET report. (Continued)

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PART III ATTACHMENTS

1. Appropriate Title

2. Appropriate Title

Sample ATET report. (Continued)

PART I, EVALUATION SUMMARY

1.0 INTRODUCTION.

1.1 GENERAL. In accordance with (IAW) the AUTOSEVOCOM Quality Assurance (QA) Program established by DCAC 310-70-57, the (state ATET organization) AUTOSEVOCOM Technical Evaluation Team (ATET) conducted an evaluation of the AUTOSEVOCOM facility at (state location) from (date) to (date). The (state organization) is responsible for the operation and maintenance of the equipment.

1.2 FACILITY DESCRIPTION. The facility consists of a SECORD with eight wideband subscriber terminals (WBST), one HY-2 equipped narrowband trunking unit (NBTU), and one HY-11 equipped NBTU. The HY-2 NBTU is connected to the (state name) AUTOVON switch. The HY-11 equipped NBTU is connected to the (state name) AUTOVON switch.

1.3 TEAM COMPOSITION.

Name	Rank/Rating	Title
John L. Doe	CPT	Team leader
David P. Norman	GS-11	Team engineer
Steven M. Kris	TGST	Cryptographic technician

1.4 KEY PERSONNEL CONTACTED.

Name	Rank/Rating	Organization/Office
R. L. Viny	CDR	NAVCOMSTA-XXXX/Commander
F. A. Miller	CDR	NAVCOMSTA-XXXX/Executive Officer
E. F. Hutchs	LCDR	NAVCOMSTA-XXXX/Electronics Officer
K. P. Payne	RML	NAVCOMMSTA-XXXX/Quality Assurance Supv

1.5 REFERENCES. The evaluation was conducted IAW the procedures contained in DCAC 310-70-57, Suppl 3. Individual equipment items/lines were evaluated according to procedures and specifications contained in the publications listed.

Sample ATET report. (Continued)

Equipment/Line	References
KY-3, HY-2, HY-11, SCS, SECORD	
WESCOM SFU, KG-13, MD-823 Modem	NAVELEX 0967-426-9010(C)
Wideband lines	NAVELEX 0967-426-9010(C) DCAC 300-175-9
Narrowband lines	DCAC 310-70-57, Suppl 1/DCAC 300-175-9
Other equipment	Appropriate TM, NAVELEX, TO Manual

2.0 GENERAL EVALUATION SUMMARY.

2.1 OVERALL FINDINGS. The overall equipment items/line findings follow. A unit was "out-of-specs" if significant adjustments or corrective actions were required to meet the referenced technical specifications.

Equipment/Line	Number Evaluated	Number Out-of-Specs Pre-Eval	Post Eval
SECORD	1	1	0
KY-3 (NBTU)	2	2	1
HY-2	1	1	0
HY-11	1	0	0
SCS	2	2	2
KG-13	2	0	0
Modem (MD-823)	1	0	0
Modem (Rixon 9601)	1	0	0
Single Frequency Unit (SFU)	2	1	0
Narrowband (NB) Lines	2	2	1
KY-3 (Subscriber)	8	5	1
Wideband (WB) Lines	8	3	1

2.2 EXCEPTIONS. The WB lines for the trunk KY-3s were not evaluated because of their proximity, approximately 100 cable feet, to the SECORD.

2.3 CONCLUSIONS. The secure voice service provided at this facility is being significantly degraded by a combination of poorly aligned equipment and/or the connecting WB and NB circuits. Subscriber and operating information was either missing or erroneous in many instances.

Sample ATET report. (Continued)

Interswitch service was not acceptable because of poor voice quality at six of eight KY-3 terminals. Five subscriber terminals were significantly malaligned resulting in weak or distorted audio. Additionally, high impulse noise on three WB circuits resulted in continuous "popping" noise on two of the five malaligned terminals and also affected on "in-spec" equipment. Calls processed to other switches were further degraded by a malaligned (high pitch) HY-2 on trunk 1 and a malaligned KY-3 (high distortion) on trunk 2. SECORD operational status indications were not functioning for preempt detection or generation on both trunks due to incorrectly aligned SCSs. Other equipments/lines were "out-of-spec" but were not significantly affecting voice quality or call processing. Subscribers and operators were generally not aware of the correct use of the system because of the lack of information and procedures as required by DCA Pacific Circular 310-S70-3(C).

3.0 MAINTENANCE EVALUATION SUMMARY. The ATET with the assistance of the local maintenance agency attempted to meet all equipment/line specifications through alignment, replacement of defective component boards, or repair action as required. Subparagraph 3.1 identifies deficiencies that were corrected during the evaluation and lists the maintenance actions taken. Subparagraph 3.2 identifies deficiencies that could not be corrected because of complexity of the problem, insufficient local resources, or time constraints. A concise discussion and the recommended corrective action are provided for each deficiency not corrected by the ATET.

3.1 DEFICIENCIES CORRECTED.

3.1.1 The trunk 2 KY-3 transmit signal was weak and distorted. Discussion: The trunk 2 KY-3 was out of specifications for frequency response, signal distortion, and static response. All parameters were aligned without replacing any equipment cards.

3.1.2 The trunk 1 HY-2 was out of alignment for several parameters. This caused the receive reconstructed voice to be higher pitched than normal and distorted the transmit voice. Discussion: The HY-2 was not properly aligned for VOGAD gain, spectrum coding, buzz hiss, and output amplifier adjustments. The results of these parameters were the local received voice was pitched significantly higher than normal and the transmit audio was badly distorted due to clipping of the overdriven audio signal. The ATET aligned all parameters and conducted training in proper alignment techniques.

Sample ATET reports. (Continued)

3.1.3 through 3.1.X. As required.

3.2 DEFICIENCIES REQUIRING CORRECTIVE ACTION.

3.2.1 The trunk 1 KY-3 frequency response did not meet alignment specifications; however, it was not noticeably affecting voice quality. Discussion: The bad frequency response was isolated to a marginal AQL board. A good spare was not available and the board could not be repaired because of lack of spare parts. All other parameters were aligned correctly. Recommendation: Repair or replace the marginal AQL board and check frequency response, max gain, and distortion and reset the output level for the KY-3.

3.2.2 Trunks 1 and 2 were not detecting or generating preempts due to improperly aligned SCSs. Discussion: The ATET aligned the Preempt Detector cards in both SCSs and operationally verified this function. Both SCSs had a Warning Tone Generator (WTG) card instead of a Tone Generator (TG) card. The WTG card is required for a NBST configuration and the TG card is the correct card for a SECORD configuration. No spare TG cards were on site so the WTG cards were left in the SCS. Recommendation: Return all WTG cards to depot IAW the AUTOSEVOCOM Logistic Support Plan and procure the required number of TG cards. The SCS will function normally excepting for preempt generation function without a card in the A5 slot.

3.2.3 through 3.2.X, As required.

4.0 OPERATIONS EVALUATION SUMMARY. The operating information, trouble reporting procedures, and other general information provided to the users and SECORD operators were examined. Specific paragraphs identify, discuss and, where applicable, provide recommendations for each deficiency.

4.1 DEFICIENCIES CORRECTED.

4.1.1 Operating instructions, trouble reporting numbers, and other general information were not posted at each WBST. Discussion: DCA Pacific Circular 310-S70-3(C) requires that the above minimum information be posted at each WBST to insure proper utilization and trouble reporting within the system. A model is provided in the Circular for this purpose. During the evaluation, subscriber information was developed and distributed. This information should be monitored in the future and periodically updated.

4.2 DEFICIENCIES REQUIRING CORRECTIVE ACTION.

4.2.1 Three operational publications required by DCA Pacific Circular 310-S70-3(C) were not available.

Sample ATET report. (Continued)

Discussion: DCACs 310-70-57 and 310-S85-6 and JANAP 138 (C) were not available. These publications provide information on the AUTOSEVOCOM QAP, procedures for a monthly two day traffic sample, and SECORD operating instructions respectively. Recommendation: Obtain these publications and insure that all operational personnel are familiar with their contents.

4.2.2 through 4.2.X. As required.

5.0 ACKNOWLEDGEMENTS. The ATET would like to thank the personnel of NAVCOMSTA-XXXX for their cooperation and assistance during the evaluation.

Sample ATET report. (Continued)

APPENDIX C

DCS TECHNICAL SCHEDULES AND PARAMETERS

The following tables were extracted from DCA Circular 310-70-1 to provide the technician a handy reference to circuit parameter codes and characteristics.

TABLE 3-1. DCS TECHNICAL SCHEDULES (con.)

ITEM NUMBER	DESCRIPTION OF DCS SERVICE	CIRCUIT PARAMETER CODE
	CATEGORY 5: AUTODIN ACCESS LINES (con.)	
5L	2400 b/s, alternate voice/record, transoceanic or international	S3
	CATEGORY 6: AUTODIN INTERSWITCH TRUNKS	
6A	2400 b/s dedicated circuit from one AUTODIN switch to another, not trans-oceanic or international.	D1
6B	2400 b/s, transoceanic or international alternate voice/record, between two AUTODIN switches.	S3
	CATEGORY 7: AUTOSEVOCOM ACCESS LINES	
7A	Secure voice terminal, 2400 b/s, to VOCOM switch.	S1
7B	Secure voice terminal, 2400 b/s, to 4-wire JOSS or 5-D switchboard, part of AUTOSEVOCOM.	S3
7C	Secure voice terminal, 50 kb/s baseband, to special 758 switch, cordboard (SECORD) or VOCOM switch, over metallic facil-ities.	Z2
7D	Secure voice terminal, 50 kb/s baseband, to special 758 switch, cordboard (SECORD) or VOCOM switch or AN/FTC-31 over long distance carrier facilities.	Z4
7E	Secure voice terminal, 50 kb/s baseband, to AN/FTC-31, over metallic facilities.	Z1

TABLE 3-1. DCS TECHNICAL SCHEDULES (con.)

ITEM NUMBER	DESCRIPTION OF DCS SERVICE	CIRCUIT PARAMETER CODE
	CATEGORY 8: AUTOSEVOCOM TRUNKS	
8A	50 kb/s baseband, over metallic facilities without regenerators.	Z3
8B	50 kb/s baseband, over long distance carrier facilities.	Z4
8C	2400 b/s (VOCOM switch to either a VOCOM switch or a special 758 switch).	S1
8D	2400 b/s (JOSS to either a JOSS or a cordboard) (SECORD).	S3
8E	2400 b/s (SEVAC to JOSS or 5D switchboard)	S3

#

TABLE 3-2. DCS TECHNICAL SCHEDULES
CIRCUIT PARAMETERS

Characteristics	Unit of Meas	S1	S2	S3	V1	V2	D1	D2	N 1, 2, and 3
a. Frequency Response kHz	dB								
0.3-2.7								-2 to +6	
0.3-3.0		-2 to +6	-1.5 to +4.5	-1 to +3		-3 to +8	-2 to +6	-3 to +12	
0.4-2.8					-8 to +20				
0.5-2.8		-1 to +3	-0.5 to +2	-0.5 to +1.5			-1 to +3		
0.6-2.4					-7 to +12				
1.0-2.4								-1 to +3	
0.7-2.3						-1 to +3			

In the above table, loss frequency characteristics are given in terms of comparison to the measured loss at 1000 hertz. For example, in the S1 schedule the loss frequency characteristic should not exceed the range of 2 dB less loss (-) to 6 dB more loss (+) between 0.3-3.0 kHz when compared to the measured loss at 1000 hertz.

TABLE 3-2. DCS TECHNICAL SCHEDULES (con.)

CIRCUIT PARAMETERS (con.)

Characteristics	Unit of Meas	S1	S2	S3	V1	V2	D1	D2	N 1, 2, and 3.
b. Maximum envelope delay distortion	micro-sec								
kHz									
0.5-2.8		3000	1500	600			3000		
0.6-2.6		1500	750	300			1500		
1.0-2.4								1000	
1.0-2.6		500	250	100			500	1750	
c. Maximum Net Loss Variation	dB	±4	±3	±2	±4	±2	±4	±4	
d. Maximum Change in Audio Frequency	Hz	±5	±5[1]	±5[1]	±5	±5	±5	±5	

[1]Circuits within CONUS ±3 Hz.

TABLE 3-2. DCS TECHNICAL SCHEDULES (con.)

CIRCUIT PARAMETERS (con.)

Characteristics	Unit of Meas	S1	S2	S3	V1	V2	D1	D2	N 1, 2, and 3.
e. Minimum Longitudinal Balance	dB	40	40	40	40	40	40	40	
f. Maximum Total peak telegraph distortion	%								20
g. Maximum Mark or space bias distortion	%								12[4]
h. Maximum Allowable channel noise[2&3]	dBrnCØ								
0-50 miles		31	31	31	31	31	31	31	
51-100		34	34	34	34	34	34	34	
101-400		37	37	37	37	37	37	37	
401-1000		41	41	41	41	41	41	41	
1001-1500		43	43	43	43	43	43	43	
1501-2500		45	45	45	45	45	45	45	
2501-4000		47	47	47	47	47	47	47	
4001-8000		50	50	50	50	50	50	50	
8001-16000		53	53	53	53	53	53	53	
i. Maximum Single tone interference below circuit noise in each mileage category	dB	3	3	3	3	3	3	3	

[2] D1 and D2 allowable channel noise for Government-owned circuits 47 dBrnCØ for all distances shown above.

[3] Consider a satellite channel as equivalent to a 2000-mile landline channel in determining circuit length.

[4] For Government-owned circuits: 5%.

TABLE 3-2. DCS TECHNICAL SCHEDULES (con.)

CIRCUIT PARAMETERS (con.)

Characteristics	Unit of Meas	S1	S2	S3	V1	V2	D1	D2	N 1, 2, and 3
j. Impulse Noise Ref level 71 dBrnCØ 72 dBrnØ voice band wtg	Max Counts in 15 min above ref level	15	15	15			15	15	
k. Terminal Impedance 600 ohm[5]	% tolerance	±10	±10	±10	±10	±10	±10	±10	
l. Composite Data transmission level	dBmØ	-13	-13	-13	-13	-13	-13	-13	
m. Phase Jitter (peak to peak)	Degrees	15	15	15			15	15	
n. Harmonic Distortion[6]	dBmØ	-40	-40	-40	-40	-40	-40	-40	

[5]For leased circuits measured at 1000 Hz; For Government-owned circuits measured across the frequency band of interest.

[6]Applies to the measurement of any of the harmonics of a test frequency of 700 Hz introduced at a level of -10 dBmØ.

TABLE 3-2. DCS TECHNICAL SCHEDULES (con.)

CIRCUIT PARAMETERS Z1, Z2, and Z3

Z1 through Z3 establish the engineering parameters for the 50 kb/s encrypted voice transmission system designed to provide service within the approximate bandwidth of 10-50,000 Hz over facilities # without regenerators.

General:

Mode of operation.	Full Duplex.
Termination.	Four wire.
Impedance - Source & Load.	135 ohms, nominal midband, balanced.
Signal Input (Baseband).	Ø dBm (1.Ø4v p-p).

CHARACTERISTIC	UNIT OF MEASURE	Circuit Parameters Z1	Z2 SUB.TO SWITCH	Z2 SWITCH TO SUB.	Z3
# a. Line up loss[7]	dB				
kHz					
0.01		+15		+15	
0.1	-	+13		+13	
1.0	-	+12		+12	
10.0		+20		+20	
50.0		+30		+30	
0.01-50.0			-2to+2		-2to+2
1.0 -40.0			-1to+1		-1to+1
# b. Delay characteristic	Micro-second	See page 3-2			
# c. Maximum loss variation[8]	dB	±4	±4	±4	±4
# d. Noise characteristics[9]	dB $\frac{S+N}{N}$	> 20	> 20	> 20	> 20

[7]These are maximum values. Shorter circuits will have less and will generally correspond to the slope characteristic shown.

[8]Referred to lineup losses.

[9]Signal plus noise of pseudo random signal at normal transmission level measured at the user terminal with a true RMS voltmeter and with the line terminated in 135 ohms. Noise is measured with same meter at the user terminal with signal removed and input terminated.

TABLE 3-2. DCS TECHNICAL SCHEDULES (con.)

CIRCUIT PARAMETERS Z1, Z2, and Z3

Z1 through Z3 establish the engineering parameters for the 50 kb/s encrypted voice transmission system designed to provide service within the approximate bandwidth of 10-50,000 Hz over facilities without regenerators.

General:

Mode of operation.	Full Duplex.
Termination.	Four wire.
Impedance - Source & Load.	135 ohms, nominal midband, balanced.
Signal Input (Baseband).	Ø dBm (1.Ø4v o-p).

	CHARACTERISTIC	UNIT OF MEASURE	Circuit Parameters			
			Z1	Z2		Z3
				SUB. TO SWITCH	SWITCH TO SUB.	
	e. Impulse noise	Max peaks per second exceeding 12 dB below peak signal level.	1	1	1	1
#	f. Supervisory signal inputs.		See footnote 10	See foot-note 10	See footnote 10	See footnote 10

[10] Supervisory Signal Inputs

A. Parameter Z1

Ringing Tone	1000 Hz (Range -6.5 to +5.0 dBm).
On Hook	2600 Hz at -21 dBm.
Voice	-17.5 VU

B. Parameters Z2 and Z3

Ringing Tone	1000 Hz (Range -6.5 to +5.0 dBm).
On Hook	2600 Hz at -21 dBm.
Dial Pulsing	2600 Hz burst at -9 dBm.
On Hook Return	2600 Hz at -9 dBm for nominal 260 (Range 220 to 320) milliseconds followed by 2600 Hz at -21 dBm.
Voice	-17.5 VU

TABLE 3-2. DCS TECHNICAL SCHEDULES (con.)

CIRCUIT PARAMETERS Z4

Characteristic	Unit of Measurement	Circuit Parameter Z4 4-Wire Carrier Full Duplex Operation Subscriber to Subscriber or Switch to Switch
Nominal data signal amplitude (input/output)	Volts, peak-to-peak (P-P)	1
Impedance (balanced input/output)	Ohms	135
Data rate at baseband (NRZ)	Kilobits/second	50
Jitter from terminal equipment (maximum)	% Isochronous distortion (=P-P jitter)	20
Jitter to terminal equipment (maximum)	% Isochronous distortion (=P-P jitter) (Assumes 0-20% jitter from terminal equipment)	33

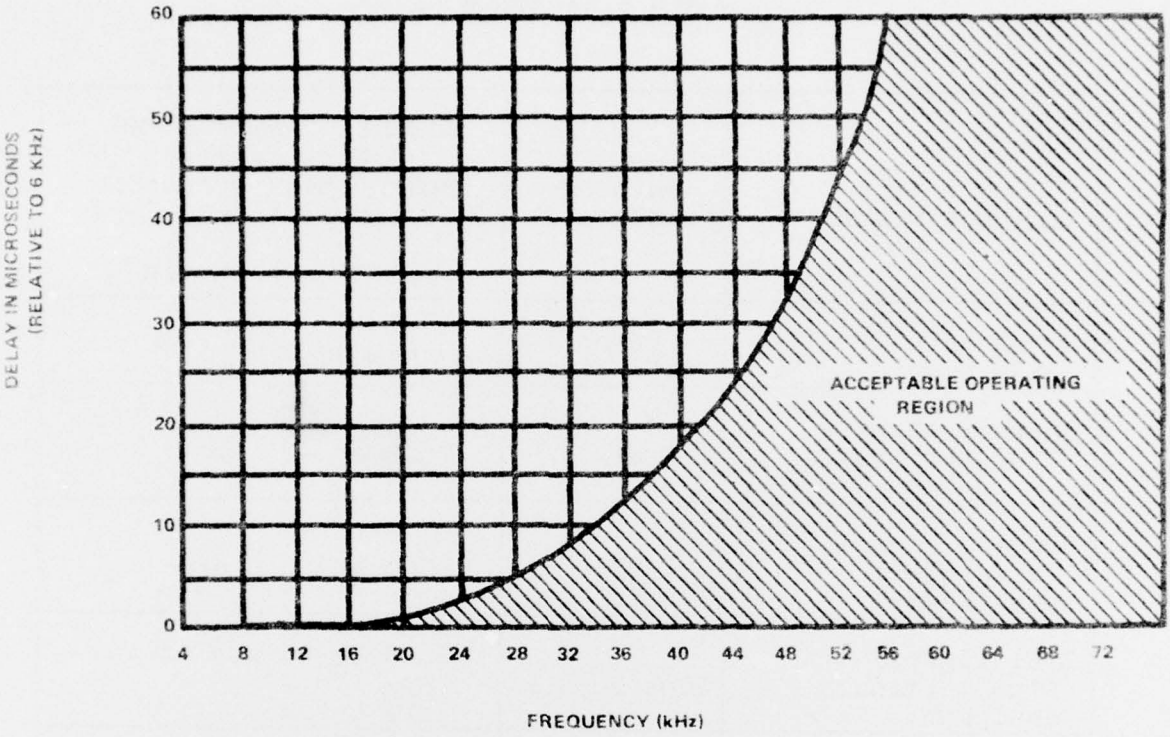
Z4 establishes the engineering objective for the 50 kb/s encrypted voice transmission system designed to provide service, within a bandwidth of 48 kHz, over long distance carrier facilities.

TABLE 3-2. DCS TECHNICAL SCHEDULES (con.)

CIRCUIT PARAMETERS Z4

Characteristic	Unit of Measurement	Circuit Parameter Z4 4-Wire Carrier Full Duplex Operation Subscriber to Subscriber or Switch to Switch
Error rate objective	Error rate/time	See footnote[13]
On-hook signal from terminal equipment	Hz	2600 at -21 dBm
Ringing signal to terminal equipment	Hz	1000 at -6.5 dBm
Dial signal from terminal equipment	Tone bursts	2600 Hz bursts at -9 dBm 10 PPS, 61% break
On-hook signal following off-hook from terminal equipment	Hz	2600 Hz at -9 dBm for approximately 260 milliseconds
Forwarding switching time (approximately)	Milliseconds	400 (following end of last dialed digit)

[13]The burst rate shall not exceed one error burst per minute averaged over a 1-hour test period. One error burst is not to exceed 350 bits averaged over a 1-hour test period. The average number of bits per burst is equal to the total of bit errors divided by the number of bursts.



1. Above curve represents Envelope Delay Requirements. Limits are not specified below 6 kHz.

2. If the entire circuit consists of properly amplitude equalized twisted pair cable, from which all loading coils and bridge taps have been removed, no delay equalization should be required. Given the correct frequency response over the range of .01 to 50 kHz (no discontinuities or sharp rolloffs), envelope delay will not normally be an item for concern on cable pairs.

3. Should the circuit contain carrier facilities, delay equalization must be employed such that the delay versus frequency response of the circuit is a smoothly and continuously increasing function of frequency, which falls within the shaded area of this figure.

FIGURE 3-2. RELATIVE ENVELOPE DELAY VS. FREQUENCY LIMITS

FOR THE COMMANDER:

OFFICIAL

C.E. McKNIGHT, JR.
Colonel, GS
Chief of Staff

M.K. LABAR
Colonel, AGC
Adjutant General

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